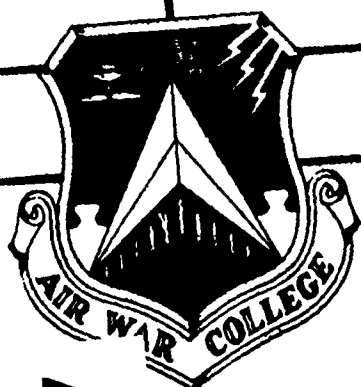


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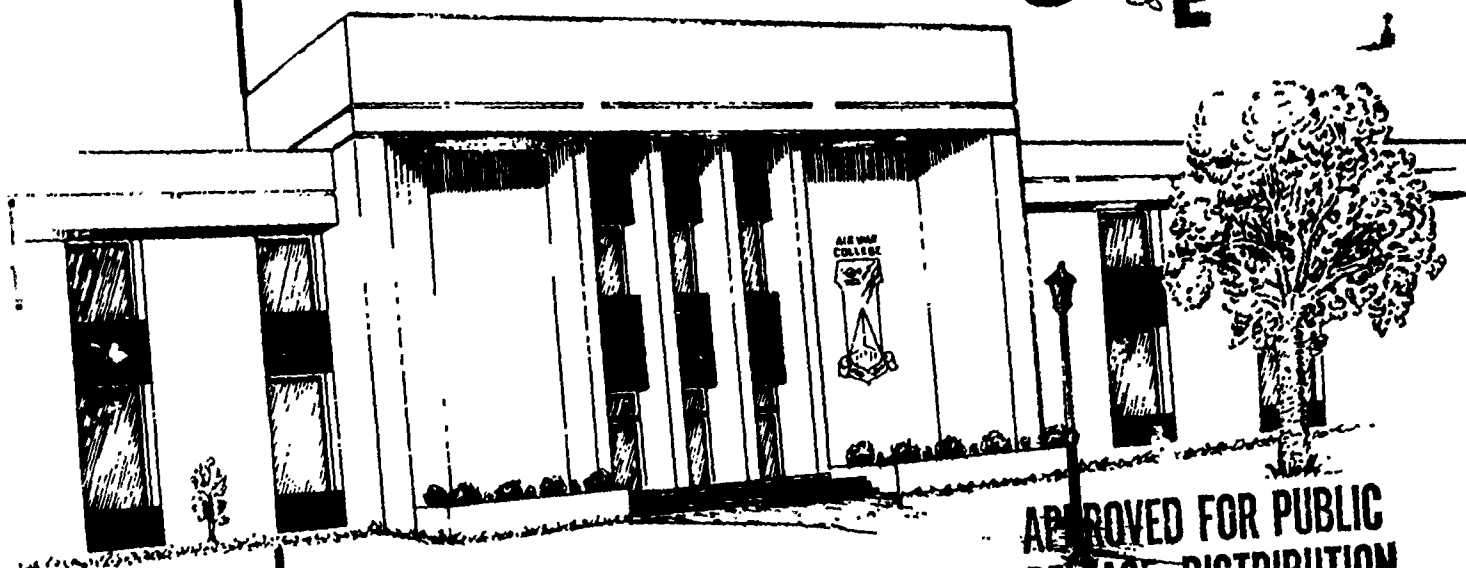
TEACHING MILITARY ETHICS AS A SCIENCE II

LT COL FRANK L. CARSON, USA

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The author extends his appreciation to Dr. William F. Grams, Professor of Mathematics, Embry Riddle Aeronautical University, for his assistance and contributions to the statistical analysis; United States Army Second Lieutenant Larry Thomas for his computer expertise and personal assistance in "crunching the numbers"; United States Army Lieutenant Colonel James McCord, Professor of Military Science, Embry Riddle Aeronautical University, whose cooperation and that of his Army ROTC students made this study possible; United States Air Force Lieutenant Colonel James C. Stayton, Air War College, for his keen insight into the subject of ethics; United States Air Force Majors Patrick L. Ivey and William E. Magill, Air Command and Staff College, for their assistance in administering the control group surveys; and United States Army Colonel Graham W. George, Jr., Air War College, for his encouragement and counsel during the course of this project.

## EXECUTIVE SUMMARY

TITLE: Teaching Military Ethics as a Science II

AUTHOR: Frank L. Carson, Lieutenant Colonel, USA

This is a report of replication research on scientific ethics. The scientific methodology is essentially the same as that used by Dr. Frank G. Forrest in his original research.

The original research applied the scientific method to validate a new science of ethics, called valuemetrics. Prior to this research, teaching ethics as a science was without precedent in the literature. The results of the research were potentially profound; findings supported the hypothesis that learning valuemetrics could increase the value judgement capability of university ROTC students when compared to philosophic based ethics instruction. If the findings could be replicated, valuemetrics could impact leadership training.

The replication research, conducted between November 1988 and March 1989, used university Army ROTC students as an experimental group and Air Command and Staff College officers as the control group.) Findings supported the conclusions in the original research and further suggested that the learning that took place in the experimental group was indeed "real."  
Key words: Value Judgement, Ethics, Psychology. JST  
In conclusion, the study of valuemetrics enhances one's value judgement capability, provides a tool to objectively quantify ethical behavior, and has the potential to revolutionize military ethics and leadership training programs.

### BIOGRAPHICAL SKETCH

Lieutenant Colonel Frank L. Carson (M.A., Psychology, Webster University) enlisted in the Army in June 1966 and subsequently went on to serve first as a warrant officer and then as an officer in diverse leadership positions within Army aviation, armor and Combat Arms units. He served in South Vietnam as a gunship pilot in 1967-68, as a aviation platoon leader in 1971, and holds the Silver Star and Purple Heart. He has commanded Army units at the company and battalion levels. Lieutenant Colonel Frank L. Carson is a graduate of the Army's Armor Officer Basic and Advanced Courses, the Command and General Staff College and is a graduate of the Air War College, class of 1989.

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## SECTION I

### INTRODUCTION

#### Background

One recent approach to close the ever-widening gulf between technological and ethical knowledge is the study of ethics as a science. In early 1988, within the paradigm of a field experiment, an introductory course in scientific ethics was taught to university senior ROTC students. The instruction produced statistically significant results and the implications for ethics training were potentially profound.

In May 1987, Dr. Frank G. Forrest (COL, USA Ret) introduced this researcher, then serving as Professor of Military Science at Embry Riddle Aeronautical University, to the fundamentals of a new science of ethics, called valuometrics. Dr. Forrest had devoted many years of scholarly study to the development of valuometrics, and he believed he had achieved a major breakthrough in transitioning the new science from its academic and theoretical basis to its practical application. Essentially, valuometrics was Dr. Forrest's application of elementary set theory, or Hartmanean algebra, to the study of ethics and moral phenomena for the purpose of making value judgements. An extract from his latest book, Valuometrics: The Science of Personal and Professional Ethics provides an overview of valuometrics, and is at Appendix F.

At that time it appeared to this researcher that an introductory course in valuometrics for the senior Army Reserve Officer Training Corps (ROTC) students would be con-

sistent with the objectives of Army ethics instruction. Dr. Forrest was therefore invited as a guest lecturer to teach an introductory course in scientific ethics to the Army ROTC students in order to supplement their ethics instruction. It was felt that such an innovative lecture series had the potential of offering a new approach to the way students viewed moral goodness, and at the very least it promised to provide a unique academic basis for further classroom discussions on the subject.

During his preparations for the introductory course in valuemetrics, Dr. Forrest saw the opportunity to validate his new science of ethics by subjecting it to the rigors of a scientific test. He elected to do a field experiment based on an "experimental group--control group, pretest--posttest" design to test his hypothesis that his introductory course had the potential of providing, for the first time, a measurable, quantitative dimension to the leadership ethics instruction of Army ROTC cadets; and that the change in the way students would see moral goodness as a result of learning valuemetrics would advance their ethics skills beyond the stage that could be achieved through the philosophic based ethics instruction in the ROTC syllabus.

In order to conduct the original field experiment, a class of senior ROTC students from the Air Force ROTC unit at Embry Riddle Aeronautical and the Army ROTC units at Stetson University, Deland, Florida and the University of Central Florida, Orlando, Florida participated as the control groups: the experimental group consisted of the senior Army cadets at



Embry Riddle Aeronautical University that were already scheduled to receive the guest lecturer series in valuometrics.

Dr. Forrest's research was unique in that for the first time the subject of ethics was being taught scientifically. Value science was taught to a group of university ROTC students, and at the end of that instruction, a scientifically accepted testing instrument, a modified version of the Hartman Value Profile, was used to measure their abilities to discern degrees of goodness as compared with other ROTC students who had only received philosophic based ethics instruction. A statistical analysis of the results showed that the experimental group members, after receiving valuometrics instruction, demonstrated a statistically significant improvement in their ability to understand the concept of "goodness" when compared with students in the control groups that had received the philosophic based ethics instruction.

Dr. Forrest's Report of (original) Research is the principal source document upon which this replication research is based. (Appendix A)

#### Purpose.

The purpose of this replication research is to essentially replicate Dr. Forrest's original field experiment, to include the original methodology, in order to determine whether or not a new science of ethics, called valuometrics, will show consistent results; further, if the replication study should validate the original findings, to examine the nature of the ethical learning that allegedly takes place.

### Significance of Replication Research

If research were able to replicate the findings and conclusions that were suggested in the original field experiment, the implications for military ethics instruction and society in general could indeed be profound. Considering the remarkable results Dr. Forrest was able to achieve with ROTC students in the original field experiment, it seemed appropriate that a replication study be conducted within the military school system as soon as practicable. A validated science of ethics has the potential to make a major, positive impact on leadership and ethics instruction in the military, a profession whose very foundation depends on strong ethical knowledge and practice. This connection is best stated on page one of the Army's Leadership Manual:

What you are (your beliefs, values, ethics and character) is the most important part of your leadership. (1:1)

The importance of values and ethics to the military decisionmaking process is clearly expressed in an unofficial Army War College reference text:

Decisionmaking is an integral part of any organization and involves ethical questions concerning the rightness, goodness, or justice of human conduct. In this context we may define ethics as the application of values to the process of making a decision. (2:7-2)

To the degree that a more efficient and effective method of teaching ethics will enhance leadership, this in turn would directly effect the military's warfighting capability, as emphasized in the Army's Operations Manual:

In the final analysis and once the force is engaged, superior combat power derives from . . . above all, the quality of their leadership. (3:14)

The Air Force's unofficial leadership and ethics manual also indicates the requirement for acute, moral sensitivity among military leaders:

Given this critical uniqueness of the role of military leaders, no nation can afford to have them be intellectually incompetent or morally insensitive. . . . It is also quite clear that neither competence nor moral sensitivity are acquired by mere contract; military leadership in these areas must proceed by example and by education. (4:107)

The original field study suggested that valuemetrics offered a more efficient means for future military leaders to assimilate the subject of ethics; if this can be validated, then the study of scientific ethics, when compared with philosophical ethics training, also has the potential to provide large returns for leadership development and the military profession for a comparatively small investment in manpower, equipment, facilities and funds.

SECTION II  
VALUOMETRICS

Theory

The discipline of valuometrics, or the science of ethics, was an outgrowth of Dr. Robert S. Hartman's concept of fulfillment theory and his calculus of value. (5) Valuometrics, as a discipline, serves as the theory and mathematics for the science of ethics, or formal axiology. (6:43) As an axiomatic science, such as Euclidean geometry or mathematics, it is founded on a definition of value itself--what all things have in common--and then the science is structured and built upon that fundamental axiom on a basis of logic. Valuometrics is neither dependent on a definition of value based on valuing or on any other non-quantifiable and subjective sentiments or philosophies, nor is it based on any person's or group's economic, moral or religious precepts. Rather, the definition of an axiom of the science of value, just as with any axiomatic science, must be so simple, logical and self evident that it requires no proof. For example, in the case of Euclidean geometry, the fundamental axiom is simply that a straight line is the shortest distance between two points. In the formal axiology, valuometrics, the axiom of value is simply that a thing has value to the degree that it fulfills its concept, its name. (6:29) For a more in depth explanation and discussion of this subject, also see Appendix A, beginning at page 20.

### Value Vision

The study of ethics, be it philosophy or science, involves a quest for knowledge of the genus "good." Unless the question "what is good" is fully understood, the rest of ethics as systematic knowledge is without foundation. Evidence is clear that the concept of goodness is central to whatever theory or approach to ethics one may take. Therefore, the idea of being good, promoting goodness, causing no badness, and the ability to distinguish goodness from badness underpin any operational concept of the various theories of ethics. (7:40) It follows that to assess the effectiveness of a course in ethics is to determine the possible change in the ability of students to more accurately discern degrees of goodness or badness.

### Value Vision Test Instrument

The credibility of a project of this nature depends on the availability of a credible pretest and posttest measurement instrument. The measurement instrument, and its content validity, criterion-measure validity and its construct validity are discussed in Appendix A commencing on page 31. Suffice to note here that the measurement instrument does appear to meet the appropriate criteria and does measure something common to any and all instruction in ethics and is fundamental to ethics. The instrument consists of a series of statements which measures a person's sensitivity to goodness, not a personal preference for good things. The instrument is

constructed based on the mathematical constructs found within valuemetrics, and the results are scored based on a mathematical system, not on the tester's personal ideas or preferences concerning relative goodness or badness (See Appendix A, page 18). The numerical results make comparison of individuals and groups possible. The method by which these items are presented and tested is the Value Vision Chart (Appendix A, pages 34-35).

### SECTION III

#### THE RESEARCH PROJECT

##### Statement of the Research (Replication) Question

The primary research question essentially parallels and replicates that found in the original research:

What is the difference in change of the value vision of college level ROTC students produced by a short course in scientific ethics, as provided in valuometrics, using Hartmanian algebra to compute answers to ethical questions, from the change in value vision of officers produced by the study of philosophic ethics, as provided in the prescribed course in leadership and ethics at the Air Command and Staff College?

##### Subsidiary Question

This researcher wanted to clarify the nature of the ethical learning that allegedly took place in the original research. Was it not possible that the reported enhanced capability of students to discern degrees of goodness--their increased value vision--after attending a short course in valuometrics, was merely a reflection of their learning Hartmanian algebra? If so, could not this increased capability, statistically significant or not, be an artificial phenomenon, of little practical value or application outside the confines of academia or the classroom? If this were determined to be the case, it may be inappropriate to conclude that the study of valuometrics had produced any real change in student value vision at all. Many social scientists have long concluded that values, like attitudes and philosophies, are developed from an early age through family,

experiential, environmental and cultural learning. Once inculcated, perceptions of moral goodness and values, like attitudes, are thought to be extremely difficult to change. It was therefore appropriate for this researcher to ask a subsidiary question to help clarify and understand the nature of the learning that occurs during the study of valuometrics. It was important to find out if the enhanced value vision acuity, as measured by the Value Vision Chart, only reflected the mathematical treatment of values inside the classroom. Or does the study of valuometrics actually change one's internalized value vision or personal value system? The specific subsidiary question follows:

What is the difference in change of the value vision of college level ROTC students produced by a short course in scientific ethics, as provided by valuometrics, when their test responses are not constrained or limited by Hartmanean algebra, from the change in value vision of officers produced by the study of philosophic ethics as provided in the prescribed military course of instruction at the Air Command and Staff College?

#### Assumptions

The researcher made the same assumptions as in the original research, i.e. that the modified Hartman Value Profile and the Value Vision Chart do measure what they purport to measure, i.e. value vision acuteness; that members of the control and experimental groups were representative of their respective cadet and company grade officer populations; and that value vision acuteness within each population was normally distributed.



SECTION IV  
RESEARCH DESIGN AND PROCEDURES

Methodology

The field experiment is of the experimental group--control group design and replicates that of the original research. The design is restated here from Appendix A.

Yb	X1	Ya	Experimental
<hr/>			
Yb	X2	Ya	Control

Where: Y is the dependent variable (value vision) and X is the independent variable.

Yb is the pretest value vision of the experimental group and control group.

Ya is the posttest value vision.

X1 is the course of instruction in valuometrics.

X2 is the course of instruction in philosophic ethics as provided in the prescribed ACSC leadership ethics instruction.

The experimental group consisted of Army ROTC cadets at Embry Riddle Aeronautical University who were scheduled to complete their leadership and ethics program of instruction during the SY 1989 Fall Semester as prescribed in the Army's Training and Doctrine Command documents for ROTC Military Qualification Skill Level I. A sample of student officers at the Air Command and Staff College who were scheduled to complete leadership and ethics training in either the War and Morality Elective or the Air Command and Staff College Command Elective comprised the control group. As in the original experiment, the test instrument, the modified Hartman Value Profile and its associated Value Vision Chart, was used

to measure the value vision of all participants.

Although a true random sampling method was not employed in selecting the experimental or control groups, pretest results placed both the experimental and control groups, with respect to their value vision, in the same statistical population.

#### Data Collection

The Professor of Military Science, Embry Riddle Aeronautical University, supervised the administration of both the pretest and posttest value surveys to the experimental group. The experimental group attended eight, 80 minute class sessions in valuemetrics over a five week period between 31 October--7 December 1988. A summary of the Lesson Plans for the experimental group is at Appendix C. Two Air Command and Staff faculty members, the course instructors for the War and Morality Elective and the Air Command and Staff College Command Elective, supervised the administration of the pretest and posttest value surveys to the control group members in their respective courses. The control group members attended eight, two hour instructional periods or guest lecturer sessions on ethics and leadership related subjects during the period 11 January--8 March 1989. A syllabus outline for control group instruction is at Appendix E.

All survey examinations, once administered and collected, were mailed to a third party and scored by computer. Data treatment was identical to the original research except

a t-distribution of scores was used in the statistical analysis rather than a z-distribution because the number of students surveyed in each group was less than 30. (8)

## SECTION V

### STATISTICAL ANALYSIS SUMMARY

A statistical analysis of the pretest and posttest scores showed that at the pretest phase of the experiment, members of the experimental group and the control group were from the same population; that after receiving their respective courses in leadership and ethics, members of the experimental group and members of the control group were in different populations; that the improvement in the posttest scores over the pretest scores of the t1 experimental group was statistically significant; and that the improvement in the posttest scores over the pretest scores of the t2 experimental group was statistically significant. For the in depth statistical analysis of the data as collected and assembled by third parties, authored by Dr. Forrest and further verified with respect to statistical methodology, refer to Appendix B.

## SECTION VI

### FINDINGS

The findings of this replication research confirmed the validity and consistency of the findings as reported in the original research:

1) The study of valuometrics enhanced the ability of college level ROTC students to understand the fundamental and most essential feature of the discipline ethics; that is, "what is goodness" (as opposed to what things are good) to a significantly greater degree than the study of philosophic ethics as administered in the Air Command and Staff College's War and Morality Elective and the Command Elective.

2) The study of valuometrics produced a significant and positive change in the value vision of college level ROTC students (their ability to discern the highest moral good) even when they were free to use any method, to include personal beliefs, intuition or subjective reasoning, when asked to take a second posttest. Therefore, the significant change in the experimental group's value vision could not have been an artificial phenomenon created by learning to use Hartmanean algebra to find academic answers to ethical questions.

3) The study of philosophic ethics did not effect the value vision acuity of members of the control group one way or the other.

4) College level students could assimilate Hartmanean set theory mathematics required to learn valuometrics.

## SECTION VII

### CONCLUSIONS AND RECOMMENDATIONS

#### Conclusions

The evidence derived from this field experiment which was designed to replicate original research supports the conclusions as stated in the original research:

1) The study of valuometrics enhanced the value vision acuity of college level ROTC students, i.e. their ability to understand and discern degrees of goodness (as contrasted with what things are good) to a greater degree than the study of philosophic ethics found in the Air Command and Staff College curriculum.

2) The improved understanding of the science of ethics resulted in a corresponding increase in the capability to exercise more accurate value judgements on the part of the experimental group members. As Dr. Forrest noted in his original research, this conclusion is based on the logic that a value judgement is in fact an assessment of the relative goodness of something.

3) Augmentation of military ethics instruction with a course in valuometrics has the potential of effectively and efficiently enhancing the student's value vision and leadership level above the limited capability of current, philosophic based instructional programs.

4) The evidence suggests that learning the fundamentals of valuometrics and its calculus of value (Hartmanean algebra) can produce a real, internalized change in one's

values and beliefs about goodness; the experimental group's value vision was significantly enhanced even when the calculus of value was not required to be used to determine responses to ethical questions.

### Discussion

The previous, original research and this follow on research in the practical application of valuometrics provides strong evidence that the existing leadership and ethics educational programs at both college ROTC and Air University levels have little or no real effect on one of the most essential attributes of today's military leaders, i.e. their moral sensitivity. But the study of a new science of ethics, valuometrics, does. Even a short course in valuometrics produced a significant change in the way ROTC cadets viewed goodness and justice. Although ethical knowledge does not guarantee ethical behavior, the lack of that knowledge will do little to enhance ethical practice. While there is almost universal agreement on questions of right and wrong in the largest sense, it has been a much more difficult task for individuals to differentiate among complex ethical choices involving degrees of goodness or badness. It is in this realm of the more subtle ethical choices that valuometrics, once fully developed, can provide scientifically derived, precise answers.

With respect to the military profession, valuometrics promises to offer a new way of thinking about the ethical dimension of leadership.

The idea of a science of ethics will undoubtedly be controversial because of its new approach and its blatant encroachment on the age-old turf of philosophers. Perhaps the reader will not automatically dismiss these new ideas and the potential of a science of ethics off hand. Many of this researcher's initial aversions to the idea of a science of ethics have diminished, and many questions based in healthy skepticism, answered. For example, one's first reaction might be to ask the question: Who decides what is the greater good, and who decides if my responses to your ethical questions are correct or incorrect? Valometrics provides the answer. It is an axiomatic science, and the calculus of value, not some individual, provides the answer. As an aside, the answers that are provided to ethical questions by this new science of ethics are generic answers in the sense that they are not culture or religious dependent or dependent on anyone's preference for things believed to be good or right or wrong.

In the final analysis, this researcher finds it difficult to dismiss the demonstrated power of valometrics, considering what it was able to achieve during the first and now during this follow on field experiment. Considering the importance of ethics to leadership development, the military, perhaps more than any other profession, is best suited to take the lead in assessing the importance of valometrics to not only the military profession, but also to society.



### Recommendations

Considering the demonstrated efficiency and effectiveness of the new discipline valuemetrics and its potential to enhance military ethics and leadership training, recommend that:

- 1) The Army Center for Leadership, Fort Leavenworth, Kansas, conduct both an academic and practical review of valuemetrics to assess the desirability of introducing the study of this new value science into the existing Army leadership and ethics training programs.

- 2) The appropriate agency in the Air War College conduct a similar review and assessment.

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TEACHING MILITARY ETHICS AS A SCIENCE

A report of research by  
Frank G. Forrest  
June 1988

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REPORT OF RESEARCH  
IN  
TEACHING MILITARY ETHICS AS A SCIENCE

Section I  
INTRODUCTION

Premise:

Our Army is made up of people, doctrine, organization weapons, and equipment. It is leadership, however, that brings all these together and makes them work.

FM 22-100 p. 1

Premise:

What you are (your beliefs, values, ethics, and character) is the most important part of your leadership.

FM 22-100 p. 72

Premise:

The "highest moral good" is what ethics is all about.

FM 22-100 p. 91

Within the framework of leadership attributes given in FM 22-100 Military Leadership, pp. 50-52 and elsewhere, the cognitive capacities of an effective leader include ethics knowledge and technical knowledge with the former being the more important. However, the gap between the development of knowledge in these two domains - ethics and technology - is enormous.

In the form of natural science we have an ever increasing power to transform the physical world in any way desired. But we have no proportionate and parallel coherent system of values to direct the use of this power.

Henry Nelson Wieman  
Professor of Theology  
University of Chicago

Another person alarmed by this disparity said:

Our knowledge of science has clearly outstripped our capacity to control it. . . . Ours is a world of nuclear giants and ethical infants.

Omar Bradley

This suggests that the difference in the levels of our knowledge of ethics and technology is in inverse proportion to their importance, and this difference ought to be eliminated. How might this be done? Answer: advance our general understanding of ethics in the Army beyond the bounds of philosophic knowledge by developing and teaching it as a science.

The level of our technical knowledge and the nature of the world today is attributable to the transition many years ago of natural philosophy to natural science (physics). However, a corresponding transition of moral philosophy to moral science has not occurred. This situation exists neither because philosophers and mathematicians have not attempted to produce a science of ethics nor because the nature of science is incompatible with ethics. Both Rene Descartes (1596-1650) and Gottfried Leibniz (1646-1716), the inventor of differential calculus, attempted to found a science of ethics on the method of natural science, but failed. They were unsuccessful because they lacked a postulate or axiom of value from which thought and reasoning could proceed, and they attempted to account for moral goodness with conventional mathematics. However, both of these deficiencies have been overcome recently by a University of Tennessee research philosopher named Robert S. Hartman (1910-1973). The results of and the culmination of Hartman's works are contained in a text on scientific axiology (Hartman 1967).

At the beginning of this book Hartman distinguishes two methods of developing knowledge - philosophic and scientific, and he explains how science is applicable to such phenomena as goodness and value. Then, using the insights of an English philosopher, George E. Moore (1873-1958), concerning the nature of

good, Hartman defines goodness axiomatically. This definition serves as a basis for the elaboration of a system of logic utilizing Cantorean set theory that orders and accounts for instances of goodness. Whereas the works of Moore and Cantor (1848-1918) contribute to the foundation of Hartman's theory, they are just two of the many renowned scholars whose writings were used as references.

Anyone who studies Hartman looking for a working model of scientific ethics unfortunately will be disappointed. He compiled the theory and mathematics for such a model, but his untimely death in '73 left us without it. In order to fulfill this need, the author of this research project has extracted segments of Hartman's writings and has assembled a working model of scientific ethics called valuemetrics. This discipline consists of the application of set theory and Hartmanean algebra to the study of goodness and its various gradations. A person's ability to discern these gradations by intuition or by reason or both is known as his or her value vision. The relationship between a knowledge of valuemetrics and this ability is the subject of the research reported herein.



## Section II

### VALUE VISION

Value vision in some respects resembles color vision. Both are a sensitivity to certain phenomena: color vision to the particular wave lengths of light reflected from a surface, value vision to the different degrees of goodness of things be they tangible or intangible. People of varying color perception or value perception acuteness see features of the world differently. Color vision and value vision both give meaning to and influence people's lives. Ability to see colors and color patterns provide interest and attractiveness to the world around us. Ability to see goodness and degrees of goodness promotes living in harmony with the world and with each other.

While there are similarities between color vision and value vision, there is an important difference. Color vision comes at birth like a head or toe, and the condition of its keenness is congenital. Value vision, on the other hand, is learned, and is related to how one sees his or her inner self. This development starts early in life and reaches various stages of maturity as one gains adulthood.

Value vision development has relevance to leadership development because of: (1) the ethics aspects of the latter, and (2) the relationship between a person's value judgement capability and the exercise of command. Explanations of the importance of ethics to leadership are given in numerous places in FM 22-100. Accordingly, if the study of ethics is the enquiry into "what is good" and if value vision is a person's knowledge of and sensitivity to goodness, the development of keen value vision among officer and senior NCO personnel will produce a corresponding enhancement in Army leadership.

The relationship between value judgements and levels of command in the Army is depicted in a paradigm based on a model developed by Katz (Harvard

Business Review, 1955). Three types of skills necessary for carrying out the process of command and management are: (1) technical, (2) human relations, and (3) conceptual and visionary. The mix of these skills at the various levels of command is given in Figure 1.

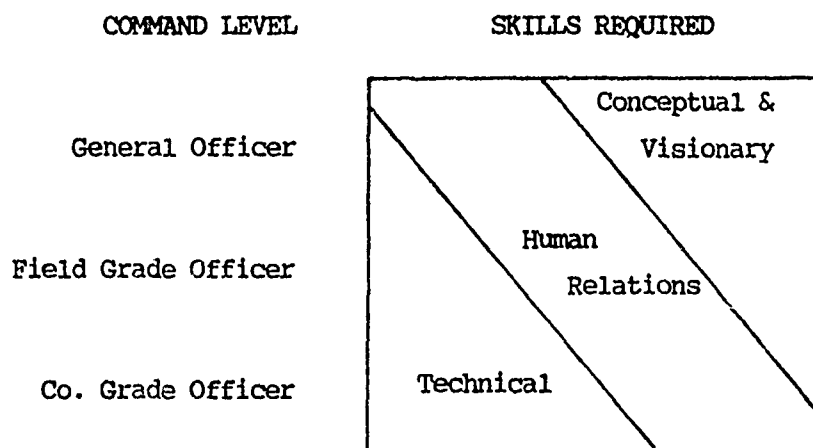


Figure 1. Relationship of Required Skills & Army Levels of Command

The three classifications of skills required of Army leaders in turn demand aptitude in decision making involving different types of judgements as follows.

SKILL	PREDOMINATE TYPE OF JUDGEMENT
Technical	Fact
Human Relations	Value
Conceptual & Visionary	Fact & Value

The requirement for value judgement competency, as indicated by the command level - skills required illustration, pervades all levels and, hence, is a vital facet of leadership. Value vision, which was defined as sensitivity to goodness, again is involved because a value judgement is in fact an assessment

of the goodness of something. How the value vision of a sample of college level ROTC students can be improved by the study of valuemetrics is revealed in the following sections of this report.

Section III  
THE RESEARCH PROJECT

1.0 STATEMENT OF THE PROBLEM

The specific question addressed was:

What is the difference in change of the value vision of college level ROTC students produced by a short course in scientific ethics, as provided in the discipline valuometrics, from the change in value vision produced by the study of philosophic ethics, as provided in the prescribed course of instruction in leadership?

2.0 ASSUMPTIONS

The researcher assumed that:

- a. A person's value vision acuteness is measurable using an adaptation of the Hartman Value Profile (Buros, 1974) which consists of a value vision chart and accompanying scoring system.
- b. The ROTC cadets participating in the project were representative of the Army and Air Force cadet population.
- c. The value vision acuteness of this population was normally distributed.

3.0 CONDITIONS OF VALUOMETRICS INSTRUCTION

- a. The duration of the course in valuometrics was the same as the time allocated to military ethics instruction in the Army and Air Force syllabus.
- b. The instruction in valuometrics was conducted in the Army and Air Force classroom facilities according to the same schedule as the prescribed ethics block of instruction.

## Section IV

### RESEARCH DESIGN AND PROCEDURES

#### 1.0 TYPE OF RESEARCH

The strategy for accomplishing the purpose of the research was to conduct a field experiment of the experimental group - control group design illustrated by the following paradigm (Kerlinger 1973).

$Y_b$	$X_1$	$Y_a$	Experimental
<hr/>			
$Y_b$	$X_2$	$Y_a$	Control

where:  $Y$  is the dependent variable (value vision) and  $X$  is the independent variable,

$Y_b$  is the pretest value vision of the experimental group and control group,

$Y_a$  is the posttest value vision,

$X_1$  is the course of instruction in scientific ethics as provided in the discipline valuemetrics,

$X_2$  is the course of instruction in philosophic ethics as provided in the proscribed Army ROTC leadership ethics instruction.

#### 2.0 SELECTION OF EXPERIMENTAL AND CONTROL GROUP MEMBERS

The experimental group consisted of those Army and Air Force ROTC cadets at Embry-Riddle Aeronautical University, Daytona Beach, Florida who were scheduled to complete ethics instruction during the 1988 spring semester. Those Army ROTC cadets at Stetson University, Deland, Florida and the University of Central Florida, Orlando, Florida who were scheduled to complete the same instruction during the same school term comprised the control group. One of the conditions of this experiment was isolation from each other by members of the two groups. This condition and the availability of subjects made random selection of experimental and control group members impractical. However, the pretest results indicated that the two groups were from the same statistical population.

## 2.0 MEASUREMENT

The instrument used to measure the value vision of the persons participating in this project was a modified version of the Hartman Value Profile - see Appendix A. Equivalent test forms were used for the pretest and posttest. Execution of both forms, called Value Vision Charts, required the respondent to rank order a series of statements according to their degree of goodness.

## 3.0 COLLECTION OF DATA

### 3.1 Experimental Group

The Army ROTC contingent of the experimental group completed the pretest under supervision of the PMS Embry-Riddle Department of Military Science 20-21 January 1988. The Air Force ROTC contingent completed the pretest 31 January-5 February 1988 under supervision of the AS 300 instructor. Both supervisors passed the completed forms to the principal researcher directly who supervised completion of the posttest by both contingents of the experimental group: the Army on 24-25 February 1988 and the Air Force on 21 March 1988.

### 3.2 Control Group

The researcher visited Stetson University and delivered copies of the pretest to the PMS who supervised their execution and who returned them by mail 13 February 1988. The same procedure occurred with respect to the University of Central Florida contingent of the control group. The researcher administered the posttest to the Stetson cadets on 20 April 1988, and the University Central Florida PMS administered the posttest to his cadets on 18-19 April 1988.

## 4.0 TREATMENT OF DATA

### 4.1 Scoring

All of the value vision examination forms were scored by computer. The

numerical ranking assigned to each item on a given chart was entered in the data base of an IBM XT. When all of the data relative to the ranking of the test items by all members of a specific group had been entered, the data was processed according to a subprogram of Lotus 1-2-3. The print-out provided: (1) individual respondent scores for the outside world, inner self, and total for each group, and (2) the means (averages) and standard deviations for the outside world, inner self, and total group scores. A respondent's score on the value vision examination is the difference between his or her rank order assignment of the various items on a chart and their mathematical rank order. Hence, the less the difference, the lower the score; and the lower the score, the keener the respondent's value vision. Value vision scores for members of the experimental and control groups are contained in Appendix B.

#### 4.2 Analysis of Data

The purpose of the analysis of data was to determine: (1) if the population represented by the experimental group and the population represented by the control group were the same at the start of the project, (2) if this condition existed at the conclusion of the project, and (3) if the differences in the pretest and posttest scores of the experimental group were due to chance occurrence of 5% or less.

The first objective was accomplished by a statistical comparison of the means of the experimental and control group pretest scores. The populations represented by the experimental group and the control group would be the same at the time of the pretest, if the difference of the mean scores of the two groups after repeated sampling varied by no more than 1.96 standard deviations (two-directional test). This was established according to the method of comparison of two population means (Mendenhall, Ott, and Larson, 1974).

The second objective was accomplished by a statistical comparison of the differences of the experimental group pretest and posttest scores with the

differences of the control group pretest and posttest scores. The method of comparison of two population means also was used for this purpose. However, in this instance a one-directional test was used.

The third objective was accomplished by determining the variance of the sum of the differences of the pretest and posttest scores for the various experimental group members, and testing the statistical significance of these differences. The method of paired differences (one-directional test) was used for this purpose.

## 5.0 STATISTICAL TEST OF HYPOTHESES

### 5.1 Test A

To determine the pretest population homogeneity of the experimental and control group.

Let:  $\mu_1$  (Greek letter mu) be the population mean score of the experimental and  $\mu_2$  the population mean score of the control group.

Null hypothesis ( $H_0$ ):  $\mu_1 = \mu_2$

Research hypothesis ( $H_1$ ):  $\mu_1 \neq \mu_2$

<u>Group</u>	<u>Pretest <math>\bar{X}</math></u>	<u>n</u>	<u><math>s^2</math></u>
Experimental	53.42	55	193.44
Control	64.73	33	1191.23

Test statistic:

$$z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n} + \frac{s_2^2}{n}}} = \frac{53.42 - 64.73}{\sqrt{\frac{193.44}{55} + \frac{1191.23}{33}}} = -1.796$$

where:  $\bar{X}_1$  is the pretest mean score for the experimental group,

$\bar{X}_2$  the pretest mean score for the control group,

$s_1^2$  the sample variance of the experimental group,



$s_2^2$  the sample variance of the control group,

$n$ , the sample size of the experimental group, and

$n$ , the sample size of the control group.

Rejection of  $H_0$ : if  $z > 1.96$  or  $z < -1.96$  ( $\alpha = .05$ )

### 5.2 Test B

To determine whether or not the mean pretest-posttest score differences for the experimental group were significantly greater than the mean pretest-posttest score differences for the control group.

$H_0: \mu_1 = \mu_2$

$H_1: \mu_1 > \mu_2$

where  $\mu_1$  is the mean of the population differences of the experimental group, and

$\mu_2$  the mean of the population differences of the control group.

<u>Group</u>	<u><math>\bar{d}</math></u>	<u><math>n</math></u>	<u><math>s_d^2</math></u>
Experimental	20.11	55	314.97
Control	.48	33	725.1

Test statistic:

$$z = \frac{\bar{d}_1 - \bar{d}_2}{\sqrt{\frac{s_{d1}^2}{n} + \frac{s_{d2}^2}{n}}} = \frac{20.11 - .48}{\sqrt{\frac{314.97}{55} + \frac{725.1}{33}}} = 3.729$$

where:  $d_{1i}$  is the pretest score minus the posttest score for the  $i^{\text{th}}$  member of the experimental group,

$d_{2i}$  the pretest score minus the posttest score for the  $i^{\text{th}}$  member of the control group,

$\bar{d}_1$  the mean of the  $d_{1i}$ 's,

$\bar{d}_2$  the mean of the  $d_{2i}$ 's, and

$s_{d1}^2$  and  $s_{d2}^2$  are the sample variances of the difference scores of the experimental and control groups.

Rejection of  $H_0$ : if  $z > 1.645$  ( $\alpha = .05$ ).

### 5.3 Test C

To determine the statistical significance of the differences of the experimental pretest and posttest scores.

$$H_0: \mu_d = 0$$

$$H_1: \mu_d > 0$$

where  $\mu_d$  is the population mean of the experimental group pretest-posttest difference scores.

<u>Group</u>	<u><math>\bar{d}</math></u>	<u>n</u>	<u><math>s_d</math></u>
Experimental	20.11	55	17.75

where:  $\bar{d}$  is the mean of the pretest-posttest score differences of the experimental group members.

Test statistic:

$$z = \frac{\bar{d}}{s_d/\sqrt{n}} = \frac{20.11}{17.75/\sqrt{55}} = 8.403$$

where:  $s_d$  is the standard deviation of the differences.

Rejection of  $H_0$ : if  $z > 1.645$  ( $\alpha = .05$ ).

### 5.4 Test Results

<u>Test</u>	<u>z</u>	<u><math>H_0</math> Rejected</u>	<u>Findings</u>
A	-1.796	No	At the time of the pretest the experimental group population and the control group populations were the same.
B	3.729	Yes	At the time of the posttest the mean reduction in value vision examination scores for the experimental group was significantly greater than the mean reduction of the same scores by the control group.
C	8.403	Yes	The mean of the differences in the pretest and posttest scores of the experimental group was significant.

## Section V

### DISCUSSION

The Army contingent and the Air Force contingent of the experimental group both received the same course in valuemetrics, but not at the same time. The Army cadets completed the course during the period 27 January - 23 February 1988, and the Air Force cadets 29 February - 18 March 1988. Army cadets attended seven class sessions of 70 minutes each for a total of 490 minutes. Air Force cadets attended nine class sessions of 50 minutes each for a total 450 minutes. The valuemetrics course presented to the Army students was the first time the researcher had ever taught the subject. Hence, it was a big learning experience for him as well as for his students despite the fact that he has written a book on the subject (Forrest, 1986). As a result of this experience, he was able to teach the Air Force cadets the skills required to make value judgements better than he accomplished with the Army cadets. Evidence of the difference in effectiveness of the two classes is revealed in Table 1 below.

Table 1  
Difference in Value Vision Change of Army and Air Force Cadets

Measure	Army		Air Force	
	Pretest	Posttest	Pretest	Posttest
Mean	58.77	41.5	49.85	27.85
Std.Dev.	12.26	17.87	13.80	9.03

An incident in the Air Force group indicates the effectiveness of the change in a person's potential for making value judgements produced by only a short introductory course in valuemetrics. Upon completing the posttest using the methodology learned during his study of valuemetrics, one cadet decided to

give each item on the chart a second ranking. The nature of the second ranking was explained by a note he wrote at the bottom of the chart: to wit, "Note: The numbers to the left of each question are my own value judgements. I wanted to see how I rate with my calculations." This means that he wished to compare his rankings according to his instincts at the time of the posttest with his rankings according to his valuemetrics calculations. His posttest score based on his calculations was 24, and his posttest score based on his instincts was 28. What makes this incident interesting, however, is that his pretest score, also based on his instincts, was 50. While this single event does not have statistical significance relative to a population, it suggests that studying valuemetrics has the potential for producing a profound change in a person's attitude and behavior, and that additional investigation to determine the existence of this possibility is warranted.

Another event conducted concurrent with this project also lends credence to the advantage of studying scientific ethics over studying philosophic ethics. The pretest value vision examination was administered to a regular class of students the first week of a college level course in values and ethics conducted by the department of philosophy. After studying for a full semester, the posttest was administered. In spite of the fact that these students studied under a highly competent professor, their performance statistically was the same as the ROTC student control group. Although these results are not the subject of this report, the implications of these matters are emphasized when one considers that knowing "what is good in and of itself" is the most essential point in studying ethics, and a mistake with regard to this question entails a far larger number of value judgement errors than any other. Unless the difference between "what is good" and "what things are good" is understood and clearly recognized, the rest of ethics has problems from a point of view of systematic knowledge (Moore, 1913).

## Section VI

### CONCLUSIONS AND RECOMMENDATIONS

#### 1.0 CONCLUSIONS

Based on the evidence of the research reported herein, the researcher concluded that:

(1) The study of valuemetrics enhanced the ability of college level ROTC students to understand the most essential feature of the discipline ethics; that is, "what is good", to a degree greater than the study of ethics as prescribed in the Army ROTC syllabus.

(2) This improved understanding produced a corresponding betterment in their value judgement capacity.

(3) Scientific ethics as portrayed in the discipline valuemetrics was within the grasp of college level ROTC students.

(4) Augmentation of military ethics instruction with a course in valuemetrics at all ROTC colleges and the various service schools has the potential for enhancing the over-all Army leadership level above its present position. This advancement has possible large returns for a comparatively small investment of manpower, equipment, facilities, and funds. However, in order to realize this potential the internalization and application of the principles and procedures of valuemetrics must be wide-spread among Army officer and senior NCO personnel.

#### 2.0 RECOMMENDATIONS AND SUGGESTIONS FOR FOLLOW-ON RESEARCH

(1) Conduct a project of the type described in this report in the Army service school system. Augment this project with a process to confirm the possible change in a person's behavior and way of thinking attributable to the study of valuemetrics. This can be accomplished simply by requesting all mem-

bers of the experimental group to complete another step after they finish ranking items on the value vision chart according to their valuemetrics calculations. Under these conditions the final step will consist of another ranking of the items on the value vision chart, but this time the respondent will be asked to order the items using any method he or she chooses.

(2) Use the findings of this research for the planning and implementation of a program for teaching scientific ethics as part of leadership training Army-wide.

(3) Initiate a longitudinal study to determine the correlation between the value vision of a large sample of Army officers, as measured by an annual value vision examination, and their general leadership ability, as revealed by a long term composite of performance evaluation scores taken from DA Form 67-8 US Army Evaluation Report.

(4) Initiate research at an appropriate agency for the development of value science beyond its present state.

## VALUE VISION CHART

### 1.0 GENERAL DESCRIPTION OF THE INSTRUMENT

The measurement instrument used in this research project was a modification of the Hartman Value Profile. This instrument measures a person's knowledge of and sensitivity to goodness, not his or her preference for things believed to be good. An examination using the value vision chart compares the respondent's numerical ranking of ideas according to his or her sense of goodness with a theoretical numerical ranking based on a mathematical system. The score on this instrument comes out as a number; the lower the number the better the value vision. The numerical results makes a comparison of individuals and groups possible. The chart consists of two parts: the first measures capacity to discern degrees of goodness in the outside world; the second, in the inner self. Each part consists of 18 items and is scored separately. The total is the sum of the scores for each part (See Exhibit 1).

The items on the value vision chart were neither selected at random nor were they chosen by a survey method of values found in American society or any other society. They do not represent any particular person's or group of person's values or preference for things thought to be good or bad. The value vision chart items are unique in that they represent a basic formula which gives them relatively exact positions in a mathematical system.

An analogy will be used to illustrate the nature of the value vision chart and its underlying system of logic. An abbreviated instrument for measuring a person's ability to discriminate gradations of distance might consist of the following format.

### DISTANCE VISION CHART

#### DIRECTIONS

Each of the statements (a - d) below has something in common. The commonality is distance. Arrange these items according to their magnitude of distance. Write the number "1" by the item of the greatest distance. Opposite the item of the second greatest distance place the number "2" and so on until the list has been exhausted. At this point you will have placed "4" opposite the item which is the least distance.

- a. ( ) Running over open ground averaging twenty miles per day for three days.
- b. ( ) A family on foot traveling for five and one-half days going eleven miles per day.
- c. ( ) Riding a horse at twelve miles per hour for five and three-fourths hours.
- d. ( ) Going through dense forest for six days making eleven miles a day.

The items on this chart have an exact position with relation to each other. One may determine these positions by applying a mathematical formula ( $v = s/t$ ) given to us by Galileo. A person's ability to order these items is measured by the match between his or her ranking and the mathematical ranking, and only this ranking. Similarly, items on the value vision chart have positions with respect to each other established by a mathematical formula ( $R = C_x^{\pm C_y}$ ) given to us by Robert S. Hartman. A person's ability to order the items on the value vision chart also is measured by his or her capacity to match the mathematical order and only this order. The derivation of the basic formula underlying the value vision chart and its application to the affairs of mankind is the essence of the discipline known as valuometrics.



## 2.0 VALUOMETRICS AND THE VALUE VISION CHART

Valuometrics begins with an objective definition of the concept "good". This definition has been missing until recently and its absence, as noted in the introduction of this report, is one of the reasons for the lag between the development of the science of ethics and the science of physics. Unlike traditional philosophic theories of ethics, which usually start with a theory of goodness in terms of things that are good such as pleasure, self-realization, duty, etc.; valuometrics starts with a definition of the genus of goodness - a statement of what all instances of goodness have in common. Obviously, such a definition must be far removed from the rich diversity of our immediate experience of goodness. If the definition is to apply to all possible instances of good, it must identify what all things that are good have in common; it must be so self-evident as to be in no need of proof; and so simple as to be incapable of proof. Only the bare bones of human experience is left. Abstractions of this sort abound in physics which are no less removed from human feelings. Hartman discovered that the place to look for an objective definition of goodness is not at good things, but at their concepts. The commonality of all things that are instances of goodness is being fully what they are supposed to be; that is, fulfillment of their meanings. Where does one find this? Answer: in the thing's concept. Every concept has a meaning, and fulfillment of meaning is what is common to all instances of good. Accordingly, the objective definition of good is: "degree of concept meaning fulfillment". A good tree, for example, is one that has all the features given in the meaning of the concept "tree"; namely, be a plant, have roots, trunk, bark. . . . leaves. This definition is an axiom in the science of ethics. It gives rise to a system of logic that orders the field of phenomena - goodness - with which this science is associated. A summary of how this occurs is described in the following section.

### 3.0 THE ANALOGY OF GEOMETRY AND VALUOMETRICS

As geometry is concerned with plane figures, valuometrics is concerned with concepts. As there are different kinds of geometric figures (rectangles, triangles, circles, etc.) there are different kinds of concepts (Type I, Type II, and Type III concepts). Type I concepts are the names of all nonspiritual intangible things. The referents of Type I concepts have no physical consistency, and they are for the most part mankind invented. Examples of this type of concept are the names of all the institutions of society, and such words as "option", "system", and "good". Type II concepts are the names of all tangible things and kinds of actions - trees, rocks, snow, lightening, and walking. This category also includes all the physical things mankind makes using natural materials such as houses, tools, airplanes, and weapons. Type III concepts are persons as individuals and groups, and spiritual things, specifically God.

Concepts have a feature that provides the connection necessary for the mathematical aspect of the science of ethics. The meaning of a concept, known in semantics as the concept "intension", is given by a series of other words or terms called predicates. This series of words or terms constitute a mathematical set. In a manner analogous to the way geometric figures have different structures, the mathematical sets of predicates that comprise the meaning of the three types of concepts have different structures. The intensions of Type I concepts are fixed finite sets. The number of elements in this type of set is known and the set has an end number. The intensional sets of Type II concepts contain certain unknown elements but for all practical purposes they have an end number and, therefore, are limited open-end finite sets. Type III concepts have intensions that comprise infinite sets.

One of the features of a geometric figure is its area. The counterpart of

this feature in valuemetrics is the index number of a concept. The basis for a concept index number, known hereafter as "value index", is the cardinality of the associated type of set. The cardinality of a set simply is the number of elements it contains. The value index of a Type I concept is the general fixed finite number "n", of a Type II concept, the general limited open-end finite number "k", and of a Type III concept, the transfinite number "aleph". In many text books the symbol " $\infty$ " is used to indicate infinity. However, the mathematician who developed set theory, Georg Cantor, saw the cardinality of an infinite set in the same light as a finite set and he assigned a number to it. He selected the first letter of the Hebrew alphabet " $\aleph$ " for this purpose. Some people have difficulty in drawing this symbol and it is not contained on a conventional typewriter. Therefore, in valuemetrics an embellished capital A i.e.,  $\mathbb{A}$  is used as the symbol for the number aleph. The hierarchy of the value indexes is such that  $n < k < \mathbb{A}$ . Also, there is a hierarchy of transfinite numbers such that  $\mathbb{A}_0 < \mathbb{A}_1 < \mathbb{A}_2$  etc.

One of the basic moral postulates in philosophic ethics is the infinite worth of a person (Titus and Keaton, 1973). Valuemetrics accounts for this postulate mathematically. In set theory there are two basic types of sets - finite and infinite. A finite set, as mentioned previously, is one that has an end number of elements. Infinite sets do not. All the possible whole numbers, for example, 1, 2, 3, 4, . . . comprise the elements of an infinite set. The individual members of this set are discrete and countable, but the counting would never end. There is another type of infinite set. This one, called a continuum, has elements that cannot be counted. The difference between a countable and a non-countable set or continuum is illustrated by the difference between a series of separate holes in the ground and a trench connecting the holes. Cantor discovered this difference mathematically and he assigned  $\mathbb{A}_0$ .

as the cardinality of a countable infinite set, and  $A_1$  as the cardinality of a continuum. Also, he proved that  $A_0 < A_1$ . If human life is of infinite worth, which index is appropriate for this value -  $A_0$  or  $A_1$ ? Hartman provided the answer as follows. The idea of the infinite value of a person is based in part on the person's power of thought. A person's thoughts, which potentially are infinite in number, are part of his or her being. The discrete thoughts of a person can be connected in any combination. If the cardinal number  $A_0$  represents the potentially infinite set of a person's discrete thoughts, then the set of all possible combinations of these thoughts is represented by the quantity  $2^{A_0} = A_1$ . For an explanation of the arithmetic of  $2^{A_0}$  see Lin and Lin, 1985, p. 146. Hence, in valuemetrics the value index of the concept "person" or any derivative thereof - human, people, etc. - or a person by name is  $A_1$ . Another approach which yields the same result is to consider the nature of something everybody possesses known as the spirit. Which type of set does the intension of the concept "human spirit" resemble - a discrete set or a continuum? Answer: a continuum. A summary of the information on concepts at this point is given in Table 1 below.

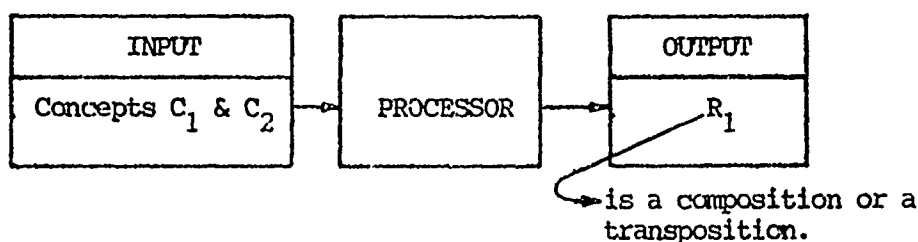
Table 1

Summary of Information on Concepts

Type	Example of Referent	Associated Type of Set	Value Index (Vidx)
I	Stock-option	Fixed finite	n
II	Bridge	Limited open-end finite	k
III	John Jones	Infinite	$A_1$

In addition to computing the areas of geometric figures it is possible to combine various types of figures for such purposes as the preparation of the floor plans for a building. The ways these figures can be combined are limit-

less. The combination of a rectangle and a triangle, for example, produces a new type of figure while two rectangles of the same size when combined in a certain manner produce another rectangle. The resultant areas of these combinations can be calculated by virtue of the fact that operations with numbers model the behavior of geometric figure combinations. These calculations provide a guide for the creation and development of all types of structures and buildings. In valuemetrics, concepts are combined instead of plane figures. Anyone of the three types of concepts (Table 1) can be combined with any other type or another of the same type. The resultant of this combination can be combined with a third concept producing a second order resultant. This resultant can be combined with another concept or another resultant to produce a third order resultant and so on. As with geometric figures there is no limit to the ways concepts and resultant concepts can be combined. The following diagram illustrates the concept combination process.



Two concepts combine compositionally when they are compatible; when one enhances fulfillment or deepens the meaning of the other. Concepts that are incompatible or that depreciate or contradict each other combine transpositionally. The combination of the two concepts  $C_1$ : truthful and  $C_2$ : reporting, exemplifies a composition in that  $C_1$  and  $C_2$  are compatible. The concepts  $C_1$ : false and  $C_2$ : reporting, also combine compositionally if in fact the report is false. However, if the report is submitted as being true, when in fact it is false, this concept combination then is a transposition in that a contradiction is involved.

Table 2  
Vidx R for All Combinations of n, k, and A,

Base Vidx	Composition			Transposition*		
	n Exp	Vidx R	k Exp	Vidx R	A Exp	Vidx R
n	$n^n = n$		$n^k = k$		$n^{-A} = 1/A_2$	
k	$k^n = k$		$k^k = k$		$k^{-A} = 1/A_2$	
A	$A^n = A_1$		$A^k = A_1$		$A^{-A} = 1/A_2$	

\* Any quantity with a negative exponent may be written as the reciprocal of the quantity with a positive exponent (Person, 1961).

\*\* See Lin and Lin, 1985 pp. 143 - 9.

Combining concepts also entails combining their value indexes  $n$ ,  $k$ , or  $A$ , . Exponentiation is the mathematical process used for this purpose. When two concepts combine compositionally, the sign of the exponent is (+); when they combine transpositionally, the sign is (-). Table 2 shows the various compositional and transpositional combinations of  $n$ ,  $k$ , and  $A$ , . There are, as disclosed in this table, 18 possible combinations of the three value indexes. These combinations are the basis of the value vision charts. Each item on a chart is an instance of a concept combination that conforms to one of the 18 value index combinations. The items in Part A of the chart consist of concept combinations of Type I, II, or III concepts that name things in the outside world. Part B consists of combinations of the three types of concepts pertaining to the inner self. This condition permits preparation of multiple versions of the value vision chart. For example:

If,  $R_1$  is the concept combination "company rules", and

$R_2$  is the concept combination "system of logic", then

$R_1 = C_1^{C_2} = n^n = n$       "Company" and "rules" are both Type I concepts ( $n$ ) and they combine compositionally (Tables 1 & 2)..

$R_2 = C_1^{C_2} = n^n = n$       "System" and "logic" also are both Type I concepts and they combine compositionally.

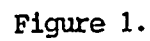
Therefore,  $R_1 = R_2$ . These two concept combinations have the same hierarchical position among the 18 items on the value vision chart, and they are comprised of concepts having the same value indexes. Hence,  $R_1$  and  $R_2$  may be substituted for each other. Similarly, all items on the chart have possible multiple substitutions.

### 3.0 SCORING THE VALUE VISION CHART

The data in Table 2 is the foundation of the value vision chart scoring system. According to these data the various concept combinations having the

**AXIOGRAM**

Date: \_\_\_\_\_





same resultant Vidx are:

Number Concept Combinations	Vidx
3	$A_2$
2	$A_1$
3	k
1	n
1	$1/n$
3	$1/k$
2	$1/A_1$
$\frac{3}{18}$	$1/A_2$

The value vision pretest and posttest charts in this project were scored by computer. However, hand scoring is easily accomplished using an 18 x 18 matrix as shown in Figure 1. The lines of the matrix are numbered from 1 - 18 and the columns are lettered a - r, but not in alphabetical order. The order of the letters from left to right is in accordance with the numerical magnitude of the resultant Vidx of the various concept combinations. In the value vision chart Exhibit 1:

items p, f, and b have a Vidx R of  $A_2$ , therefore any member of this subset warrants a numerical ranking of 1, 2, or 3;

items n and 1 have a Vidx R of  $A_1$ , therefore either may be ranked 4 or 5;

the Vidx R (items q, k, and c) = k, they rank 6, 7, or 8 in any order;

the Vidx (item e) = n, and it ranks 9;

the Vidx (item g) =  $1/n$ , and it ranks 10;

the Vidx (items j, r, and h) =  $1/k$ , and they rank 11 - 13 in any order;

the Vidx (items d and a) =  $1/A_1$ , and they rank 14 and 15 in any order;

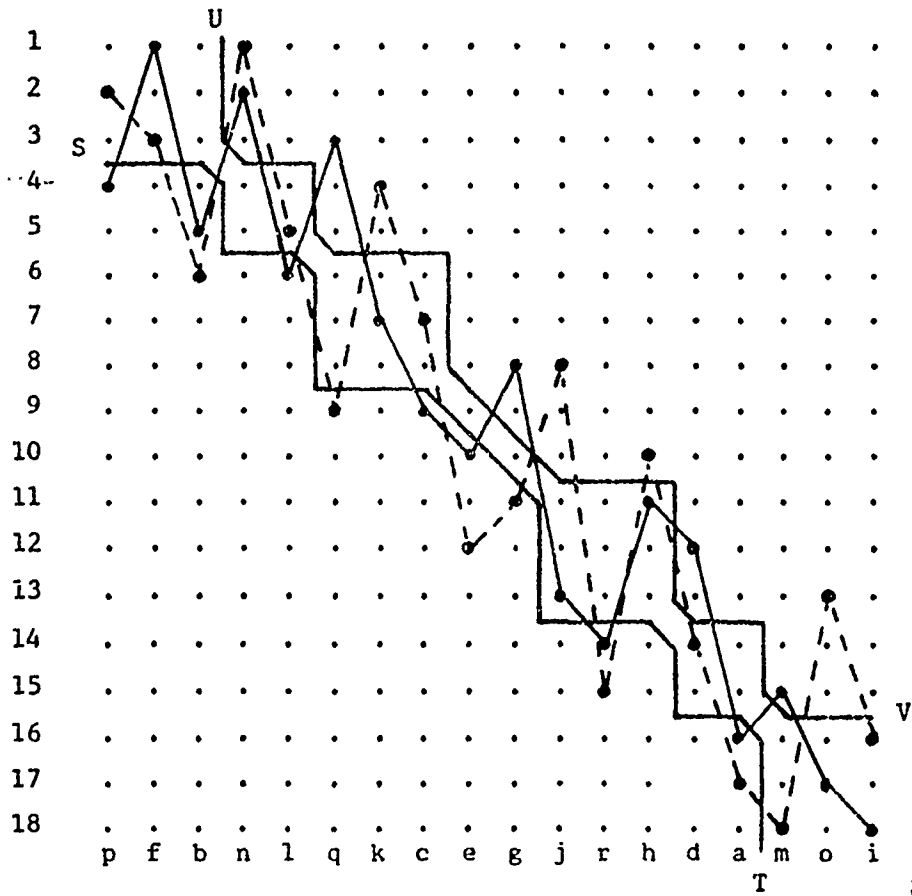
and the Vidx (items m, o, and i) =  $1/A_2$ , and they rank 16, 17, and 18 in any order.

# VALUE VISION CHART

## AXIOGRAM

Name: \_\_\_\_\_

Date: \_\_\_\_\_



Outside World  
Inner Self

1	0	2	2	1	3	0	1	1	2	0	1	0	2	1	1	0	0	18
0	0	3	3	0	1	2	0	3	1	3	2	1	0	2	0	3	0	24

Scoring Form

Value Vision Lines

————— Outside World  
- - - - - Inner Self

Figure 2.

Assume that a respondent assigned the following rankings to the various items of Part A.

a. (16)	d. (12)	g. ( 8)	j. (13)	m. (15)	p. ( 4)
b. ( 5)	e. (10)	h. (11)	k. ( 7)	n. ( 2)	q. ( 3)
c. ( 9)	f. ( 1)	i. (18)	l. ( 6)	o. (17)	r. (14)

Construction of the axiogram (Figure 2) for Part A of this person entails the following procedure:

- (1) Encircle the dot column p line 4. This action is based on the ranking the respondent assigned to item p. The dots encircled for the remaining items also are based on the respondents assigned ranking.
- (2) Encircle the dot column f line 1.
- (3) Continue this process for the remaining items in the order of the letters at the bottom of the matrix. Then connect the encircled dots successively by drawing a straight line from one encircled dot to the next. This line sloping downward from left to right is the respondent's value vision line for the outside world.

The score for an item is the difference between the ranking assigned to the item and the mathematical rank interval. When the assigned rank is the same as any number in the rank interval, the score for the item is zero. When the assigned rank is less than the smallest number of the rank interval, the score is the difference between the least number of the rank interval and the assigned rank. When the assigned rank is higher than the largest number in the rank interval, then the score is the difference between these two numbers. For example, the assigned rank of item p is 4 and the rank interval is 1 - 3. The score for this item, therefore, is 1. The assigned rank of item q is 3 and the rank interval is 6 - 8. The item q score, hence, is 3. In accordance with this process a score for each item is obtained.

Part B of the examination is scored by the same method. The respondent's hypothetical value vision line for the inner self is displayed in Figure 2. The sum of the individual item scores for Part A added to the sum of the scores for

Part B is the total score for the chart. The degree to which the lines connecting the encircled dots lie within the area bounded by the lines S -T and U - V of the axiogram, the more acute the value vision of the person concerned.

#### 4.0 VALIDITY OF THE VALUE VISION CHART

The extent to which the value vision examination measures what it purports to measure will be demonstrated by the conventional evidences of validity. They are: content validity, criterion-measure validity, and construct validity (Thorndike and Hagen, 1967).

##### 4.1 Content Validity

The value vision chart measures the respondent's talent for ordering the gradations of the goodness of things. The chart, therefore, must contain all or a representative sample of the indicators of these gradations. The indicators of the various gradations of goodness are certain combinations of the three types of concepts. This condition exists because goodness is defined in terms of concepts; to wit, goodness is degree of concept intension fulfillment (par. 2.0). If there are three types of concepts (par. 3.0) having different types of intensional sets, then there are three types of goodness. The goodness associated with a Type I concept is called systemic goodness ( $V_{dx\ n}$ ), with a Type II concept, extrinsic goodness ( $V_{dx\ k}$ ), and with a Type III concept, intrinsic goodness ( $V_{dx\ A}$ ). Accordingly, a person's sensitivity to goodness consists of his or her ability to differentiate and rank order all possible combinations of the three types of goodness. These combinations, of which there are 18, comprise the various goodness gradations. The items on Part A of the value vision chart consist of these combinations with respect to the outside world and Part B with respect to the inner self. A person's view of his or her inner self is measurable in the same manner as the outside world because, as Hartman has shown, the self has three dimensions of goodness corresponding to the three types of con-

cepts. These dimensions of the self can be represented by the three value indexes n, k, and A. Therefore, this part of the value vision chart consists of all the possible combinations of the three goodness dimensions of the self.

#### 4.2 Criterion-Measure Validity

The importance of this mode of validity depends on the purpose of the measurement instrument. Tests, examinations, and measurements that predict performance in a given task, in order to be useful, must correlate highly with some criterion-measure of the task. Establishing this aspect of validity involves data collection and statistical analysis and, therefore, is known as empirical or statistical validity. The primary purpose of the value vision chart is to measure a certain human talent that is fundamental to ethics. However, existence of this talent is presumed to be indicative of high quality leadership. This suggests that a longitudinal study to determine the correlation between the value vision of a sample of Army officers, as measured by an annual examination, and their general leadership ability, as revealed by a long term composite of performance evaluation scores taken from DA Form 67-8 US Army Evaluation Report, would be useful in assisting the Army in the ethics aspect of leadership development.

#### 4.3 Construct Validity

Construct validity is the degree a test, examination, or measure of some aspect of a person reveals something meaningful about the person. This is interpreted as any trait, capacity, or ability that is characteristic of his or her behavior and the way he or she thinks. A person's behavior and the way a person thinks often are a reflection of how he or she sees things susceptible to being viewed by the mind's eye. Goodness is something in this category. Since goodness is the fundamental notion of ethics and since ethics is crucial to leadership, the construct validity of the value vision chart on these bases

is evident.

## 5.0 RELIABILITY

The subdivided test method was used to estimate the accuracy of the value vision examination (Thorndike and Hagan, 1967). This method consists of putting all the odd numbered items in a half-test and all the even numbered items in another. The scores utilized for this purpose were the pretest results for both the experimental group and the control group. These data were the input to a reliability coefficient ( $r_{11}$ ) computed according to the Spearman-Brown Prophecy Formula.

$$r_{11} = \frac{2r_{xy}}{1 + r_{xy}}$$

where:  $r_{11}$  is the estimated reliability of the full length test and  
 $r_{xy}$  is the correlation coefficient between the items of the  
two half-tests.

The factor  $r_{xy}$  was calculated using raw test scores according to the Pearson product-moment correlation coefficient formula. Calculations according to these formulas produced an  $r_{xy} = .762$  and  $r_{11} = .865$ . Reliability coefficients determined by the subdivided test method consistently are higher than  $r_{11}$ 's determined by the alternate test method by an estimate of no greater than 10%. An alternate test is an equivalent form containing different samples of the same material as a given test, and administered several days after administration of the original test. If these conditions are taken into account, the estimated reliability coefficient of the value vision examination is:

$$r_{11} = (.865 - .1 \times .865) = .778,$$

and is considered satisfactory.

VALUE VISION CHART (2)

Name \_\_\_\_\_ Date \_\_\_\_\_

Part A (Outside World)

DIRECTIONS

Each of the 18 phrases (a - r) which appear below represents something that has a certain degree of goodness. Read each item carefully. If there is a word that you do not understand ask what it means.

Your task is to arrange these items according to your sense of goodness (good or bad) by placing numbers in the parentheses to the left of each item. Write the number "1" by the item which in your opinion represents the highest good. Opposite the item representing the second highest good place the number "2" and so on until the list has been exhausted. At this point you will have placed 18 opposite the item which you think is the worst of the bad. Judge these expressions only on the goodness or badness of their content.

In order to eliminate the possibility of two items having the same number, use the row of numbers at the bottom of the chart. Cross out each number as you assign it to a position opposite a particular item. If you decide to change the number of an item after having completed or partially completed the process, make sure that numbers assigned to other items affected by the change are adjusted.

- |   |   |
|---|---|
| a. ( ) Inhumanity toward a person.                  | j. ( ) Illegal goods.                                       |
| b. ( ) Human beings devoted to high standards.      | k. ( ) Respect for the law.                                 |
| c. ( ) Truthful reporting.                          | l. ( ) Equitable personnel policies.                        |
| d. ( ) Illegitimate child.                          | m. ( ) Denying human rights.                                |
| e. ( ) A system of logic.                           | n. ( ) A creative craftsman.                                |
| f. ( ) A person's deep concern for the environment. | o. ( ) A person chronically alienated with society.         |
| g. ( ) An illogical argument.                       | p. ( ) A father and son closely identified with each other. |
| h. ( ) Pollution.                                   | q. ( ) Recognition for loyalty.                             |
| i. ( ) Child molestation by adult family member.    | r. ( ) A false coin.  |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Part B (Inner Self)

DIRECTIONS

The 18 short sentences in this part represent possible ways a person might see himself or herself. These views also have certain degrees of goodness or badness. Accomplish the same process with these items as you did with the items in Part A. The phrase "my work" appears in several of these items. This phrase does not refer to any particular job, but rather to what you are doing, be it a profession, career, job, or attending school. If you are not pursuing an occupation, you may substitute the phrase "what I am doing" for "my work", or "my livelihood".

- |  |   |
|--|---|
| a. ( ) My work sickens me.                         | j. ( ) My goallessness inhibits my welfare.             |
| b. ( ) I value my standards.                       | k. ( ) My ethics improve my stature.                    |
| c. ( ) My status benefits my work.                 | l. ( ) My individuality is enhanced by my ideals.       |
| d. ( ) My goals discredit me.                      | m. ( ) I loath my standards and goals.                  |
| e. ( ) My position promotes my reputation.         | n. ( ) My work enriches my self-acceptance.             |
| f. ( ) My spirit bolsters fulfillment of my role.  | o. ( ) My life contributes nothing to the world.        |
| g. ( ) My standards are a disgrace to my position. | p. ( ) I am proud of who I am.                          |
| h. ( ) My job is not my kind of work.              | q. ( ) My work and my enjoyments are attune.            |
| i. ( ) I distrust my true self.                    | r. ( ) My illness prevents my gaining a higher position |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18



## NUMERICAL DATA

VALUE VISION EXAMINATION SCORES  
EXPERIMENTAL GROUP (n=55)

Member Number	Pre-Test			Post-Test			Pre-Test Total Minus Post-Test Total ( $d_1$ )
	Outside World	Inner Self	Total ( $X_1$ )	Outside World	Inner Self	Total ( $X_2$ )	
1	20	26	46	8	37	45	1
2	27	36	63	9	16	25	38
3	28	30	58	14	18	32	26
4	23	28	51	9	13	22	29
5	35	40	75	19	25	44	31
6	14	20	34	3	32	35	-1
7	21	43	64	14	12	26	38
8	32	26	58	17	24	41	17
9	20	21	41	14	11	25	16
10	29	26	55	8	21	29	26
11	27	38	65	7	19	26	39
12	10	12	22	12	2	14	8
13	22	29	51	9	23	32	19
14	27	19	46	5	5	10	36
15	14	17	31	5	5	10	21
16	24	24	48	18	5	23	25
17	26	34	60	12	14	26	34
18	17	35	52	16	14	30	22
19	39	21	60	9	29	38	22
20	18	18	36	17	21	38	-2
21	26	32	58	6	21	27	31
22	19	15	34	6	28	34	0
23	25	15	40	6	25	31	9
24	30	27	57	2	17	19	38
25	22	28	50	7	17	24	26
26	21	27	48	8	10	18	30
27	17	13	30	5	10	15	15
28	33	49	82	11	33	44	38
29	20	29	49	9	26	35	14
30	35	34	69	15	11	26	43
31	9	16	25	6	19	25	0
32	15	25	40	10	17	27	13
33	20	27	47	8	15	23	24
34	30	26	56	14	14	28	28
35	28	31	59	6	11	17	42
36	20	41	61	26	8	34	27
37	41	40	81	17	15	32	49
38	24	19	43	13	31	44	-1
39	41	37	78	33	35	68	10
40	19	24	43	52	38	90	-47
41	33	31	64	17	21	38	26
42	30	12	42	10	15	25	17

VALUE VISION EXAMINATION SCORES  
EXPERIMENTAL GROUP (n=55)  
Continued

Member Number	Pre-Test			Post-Test			Pre-Test Total Minus Post-Test Total (d <sub>i</sub> )
	Outside World	Inner Self	Total (X <sub>i</sub> )	Outside World	Inner Self	Total (X <sub>i</sub> )	
43	34	34	68	12	34	46	22
44	32	34	66	29	29	58	8
45	31	24	55	12	30	42	13
46	24	17	41	13	26	39	2
47	31	33	64	4	18	22	42
48	23	34	57	38	24	62	-5
49	14	35	49	20	19	39	10
50	47	17	64	23	24	47	17
51	20	50	70	0	20	20	50
52	19	26	45	19	49	68	-23
53	29	16	45	7	14	21	24
54	34	27	61	12	24	36	25
55	39	42	81	19	18	37	44
SUM	1408	1530	2938	720	1112	1832	1106
MEAN	25.60	27.82	53.42	13.09	20.22	33.31	20.11
S <sub>i</sub> <sup>2</sup>			193.44				
S <sub>d</sub> <sup>2</sup>							314.97
S <sub>d</sub>							17.75

VALUE VISION EXAMINATION SCORES  
CONTROL GROUP (n=33)

Member Number	Pre-Test			Post-Test			Pre-Test Total Minus Post-Test Total (d <sub>2</sub> )
	Outside World	Inner Self	Total (X <sub>2</sub> )	Outside World	Inner Self	Total (X <sub>2</sub> )	
1	34	44	78	31	17	48	30
2	15	17	32	27	26	53	-21
3	26	20	46	32	19	51	-5
4	20	29	49	35	33	68	-19
5	44	26	70	32	22	54	16
6	31	24	55	30	14	44	11
7	26	33	59	22	15	37	22
8	33	30	63	34	23	57	6
9	18	23	41	32	28	60	-19
10	25	14	39	28	17	45	-6
11	37	38	75	42	43	85	-10
12	28	14	42	29	22	51	-9
13	103	30	133	85	37	122	11
14	30	33	63	38	37	75	-12
15	32	24	56	31	26	57	-1
16	20	15	35	35	14	49	-14
17	29	36	65	39	21	60	5
18	25	26	51	37	33	70	-19
19	39	28	67	55	30	85	-18
20	24	38	62	34	37	71	-9
21	20	13	33	20	12	32	1
22	39	53	92	40	35	75	17
23	22	28	50	51	30	81	-31
24	24	27	51	29	20	49	2
25	99	124	223	53	43	96	127
26	42	28	70	21	29	50	20
27	12	13	25	20	26	46	-21
28	49	34	83	60	48	108	-25
29	36	26	62	48	20	68	-6
30	28	32	60	36	35	71	-11
31	61	24	85	36	30	66	19
32	23	35	58	43	22	65	-7
33	18	45	63	39	32	71	-8
SUM	1112	1024	2136	1224	896	2120	16
MEAN	33.70	31.03	64.73	37.09	27.15	64.24	0.48
S <sub>2</sub> <sup>2</sup>			1191.23				
S <sub>d2</sub> <sup>2</sup>							725.10

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## STATISTICAL ANALYSIS

The statistical operations described in this appendix are the various tests of hypotheses relative to the analysis of data.

## TEST A

This test was for the purpose of determining whether or not the experimental group and the control group were from the same value vision acuteness population at the time of the pretest.

The assumption made in connection with this test was that the value vision pretest scores of this population was normally distributed. This assumption was justified on the basis of a frequency distribution of the pretest scores of both groups supplemented by pretest scores on the value vision examination obtained from previous research. The frequency distribution for this sample ( $n = 196$ ) is shown in Figure 1. Figure 2 is a histogram of the same data.

Interval		Frequency
a	16 - 25	3
b	26 - 35	12
c	36 - 45	20
d	46 - 55	42
e	56 - 65	47
f	66 - 75	42
g	76 - 85	20
h	86 - 95	5
i	46 - 105	2
j	106 - 115	1
	> 116	2

Fig. 1. Frequency  
Diagram

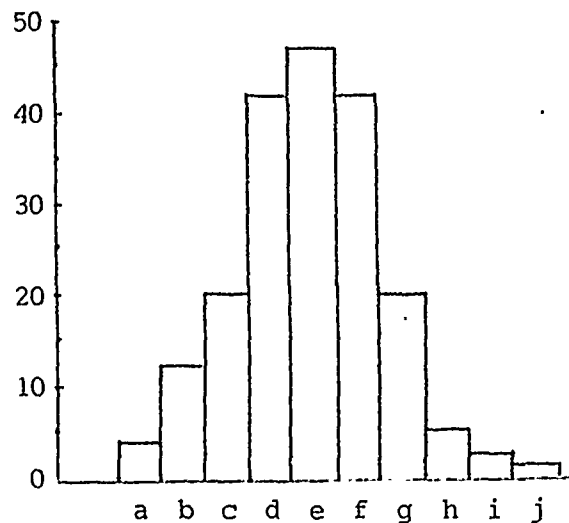


Fig. 2 Histogram

The t-test for comparing two means was the statistical operation used to determine whether or not both groups were from the same population. This test was used because both groups were small samples; i.e.,  $n < 30$ .

If  $\mu_x$  is the population mean score of the experimental group and  $\mu_y$  is the population mean score of the control group, then

Null hypothesis ( $H_0$ ):  $\mu_x = \mu_y$

Alternate hypothesis ( $H_1$ ):  $\mu_x \neq \mu_y$  (two directional test),

$$t = \frac{\bar{X} - \bar{Y}}{s \sqrt{1/n_1 + 1/n_2}} \quad \text{where}$$

$$s = \sqrt{\frac{(n_1 - 1)S_x^2 + (n_2 - 1)S_y^2}{n_1 + n_2 - 2}} \quad \text{and,}$$

	<u>Experimental Group</u>	<u>Control Group</u>
Pretest mean score	$\bar{X}$	$\bar{Y}$
Variance	$S_x^2$	$S_y^2$
Number group members	$n_1$	$n_2$

Under these conditions,  $H_0$  should be rejected if  $t$  is greater than 2.021 or less than -2.021 ( $\alpha = .025$  for  $n_1 + n_2 - 2 = 42$  degrees of freedom).

Using data from Tables 1a and 2:

<u>Group</u>	<u><math>\bar{X}/\bar{Y}</math></u>	<u><math>S^2</math></u>	<u><math>n</math></u>
Experimental	66.25	131.09	20
Control	68.71	184.54	24

An assumption relative to this test is that  $\sigma_x^2 = \sigma_y^2$ . This assumption is warranted if the difference of the sample variances is not statistically significant. The F-ratio was used to make this determination.

$$F = \frac{S_y^2}{S_x^2} = \frac{184.54}{131.09} = 1.407$$

The difference of the sample variances is not significant if  $F$  is 2.92 or less ( $\alpha = .02$  with 23 and 19 degrees of freedom). Therefore,  $H_0: \sigma_x^2 = \sigma_y^2$  was not rejected.

$$s = \sqrt{\frac{19 \times 131.09 + 23 \times 184.54}{42}} = 12.66$$

$$t = \frac{66.25 - 68.71}{12.66 \sqrt{1/20 + 1/24}} = -.54$$

The computed value of  $t$  does not fall within the  $H_0$  rejection region; i.e., greater than 2.021 or less than -2.021. Therefore, the finding of this phase of the analysis was that the experimental group and the control group at the time of the pretest were from the same value vision acuteness population.

#### TEST B

The purpose of this test was to compare the experimental group change in performance on the value vision examination with the control group change in performance as a result of their respective experiences in the study of ethics during the period of the research project. The results of this test indicated whether or not the two groups were in the same population at the time of the posttest.

Two sets of scores for the experimental group were considered for this test. The first set, given in Table 1a, is the set of pretest-posttest difference scores on the value vision examination derived by the group members using mathematical calculations learned during the course in valuemetrics. The second set, shown in Table 1b, is the set of pretest-posttest difference scores on the

value vision examination according to the group member's intuition, personal value system, and beliefs at the time of the posttest.

The assumption made in connection with this test was that the pretest-posttest difference scores for each group were normally distributed. This assumption was justified on the basis of a frequency distribution of these scores by the experimental group supplemented by data from previous research, and by a frequency distribution of these scores by the control group supplemented by the same scores of control group members obtained from previous research. The frequency distribution for the experimental group ( $n = 75$ ) is shown in Figure 3. A histogram for these data is displayed in Figure 4. Corresponding information for the control group ( $n = 112$ ) is shown in Figures 5 and 6.

Interval	Frequency
-31	1
a -30 to -21	1
b -20 to -11	2
c -10 to -1	4
d 0 to 9	8
e 10 to 19	12
f 20 to 29	23
g 30 to 39	12
h 40 to 49	5
i 50 to 59	6
j 60 to 69	1

Fig. 3 Frequency Diagram

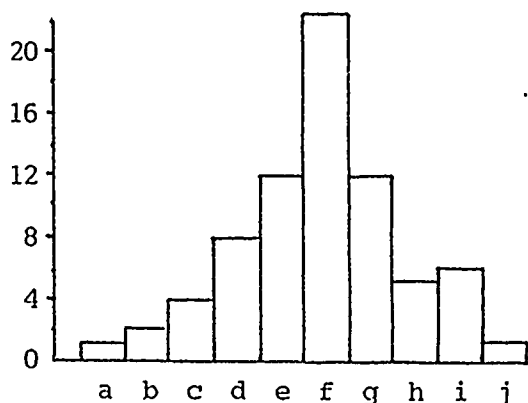


Fig. 4 Histogram



Interval	Frequency
< -41	3
a -40 to -31	5
b -30 to -21	8
c -20 to -11	24
d -10 to -1	27
e 0 to 9	23
f 10 to 19	10
g 20 to 29	5
h 30 to 39	5
> 40	2

Fig. 5 Frequency Diagram

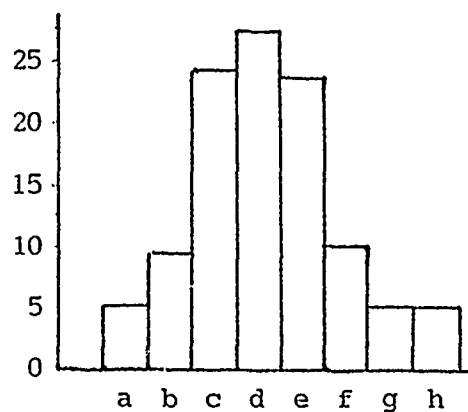


Fig. 6 Histogram

The statistical operation for determining the significance of the pretest-posttest difference scores on the value vision examination also was the t-test. If  $\mu_{dx}$  is the population mean difference score of the experimental group and  $\mu_{dy}$  is the population mean score of the control group, then

Null hypothesis ( $H_0$ ):  $\mu_{dx} = \mu_{dy}$

Alternated hypothesis ( $H_1$ ):  $\mu_{dx} > \mu_{dy}$  (one directional test),

$$t = \frac{\bar{d}_x - \bar{d}_y}{s \sqrt{1/n_1 + 1/n_2}} \text{ where}$$

$$s = \sqrt{\frac{(n_1 - 1)S_{dx}^2 + (n_2 - 1)S_{dy}^2}{n_1 + n_2 - 2}} \text{ and}$$

	<u>Experimental Group</u>	<u>Control Group</u>
Pretest-posttest difference mean	$\bar{d}_x$	$\bar{d}_y$
Variance	$S_{dx}^2$	$S_{dy}^2$
Number group members	$n_1$	$n_2$

Under these conditions, we reject  $H_0$  if  $t$  is greater than 1.684 (alpha = .05 for  $n_1 + n_2 - 2 = 42$  degrees of freedom).

Using data from Tables 1a, 1b, and 2,

<u>Group</u>	<u><math>\bar{d}_x/\bar{d}_y</math></u>	<u><math>S_{d,x}^2/S_{d,y}^2</math></u>	<u><math>n</math></u>
Experimental <sub>1</sub>	28.25	438.59	20
Experimental <sub>2</sub>	23.10	371.99	20
Control	-3.92	235.83	24

The difference of the sample variances is not statistically significant if  $F$  is 2.93 or less (alpha = .02 with 19 and 23 degrees of freedom).

$$F_1 = \frac{S_{d,x}^2}{S_{d,y}^2} = \frac{438.59}{235.83} = 1.86$$

$$F_2 = \frac{S_{d,x}^2}{S_{d,y}^2} = \frac{371.99}{235.83} = 1.577$$

Therefore, in neither case was  $H_0: \sigma_x^2 = \sigma_y^2$  rejected.

$$s = \sqrt{\frac{19 \times 438.59 + 23 \times 235.83}{42}} = 18.1$$

$$t_1 = \frac{28.25 + 3.92}{18.1 \sqrt{1/20 + 1/24}} = 5.87 \text{ and}$$

$$s = \sqrt{\frac{19 \times 371.99 + 23 \times 235.93}{42}} = 17.25$$

$$t_2 = \frac{23.1 + 3.92}{17.25 \sqrt{1/20 + 1/24}} = 5.18$$

The computed value of  $t$  in both cases falls within the  $H_0$  rejection region ( $>1.684$ ). This substantiated the finding that the mean pretest-posttest difference score for the experimental group was significantly greater than the same score for the control group. Therefore, the conclusion that at the time of the posttest the two groups were in different value vision acuteness populations as a result of their respective experiences in the study of ethics during the project was justified. This conclusion is particularly meaningful in the case of  $t_2$  where on the posttest the value vision scores of the experimental group were based on the same cognitive process that was employed on the pretest, and which was employed by the control group on both the pretest and the posttest.

#### TEST C

The purpose of this test was to determine if the difference in the pretest and posttest scores of the experimental group was due to chance occurrence. This was accomplished by the small sample paired difference test.

If  $\mu_d$  is the mean difference score of the experimental group posttest population, then

Null hypothesis ( $H_0$ ):  $\mu_d = 0$

Alternate Hypothesis ( $H_1$ ):  $\mu_d > 0$  (one directional test), and

$$t = \frac{\bar{d}}{S_d / \sqrt{n}} \quad \text{where}$$

$\bar{d}$ : mean difference score

$S_d$ : standard deviation of the mean of the difference scores

$n$ : number of group members

In this case  $H_0$  is rejected if  $t$  is greater than 1.729 ( $\alpha = .05$  with 19 degrees of freedom).

Using the data from Tables 1a and 1b,

$$t_1 = \frac{28.25}{20.94/4.47} = 6.04$$

$$t_2 = \frac{23.1}{19.29/4.47} = 5.36$$

The computed values of both  $t_1$  and  $t_2$  fall within the rejection region of the null hypothesis. This supported the conclusion that the pretest-posttest difference scores of the experimental group was not due to chance occurrence.

Table 1a

## VALUE VISION EXAMINATION SCORES - PRETEST &amp; POSTTEST ( )

EXPERIMENTAL GROUP (OCTOBER 88 - DECEMBER 88)

n = 20

MEMBER	A	B	SUM1	C	D	SUM2	A-C	B-D	SUM1-SUM2
1	19	24	43	34	29	63	-15	-5	-20
2	58	20	78	36	13	49	22	7	29
3	25	25	50	21	6	27	4	19	23
4	33	13	46	10	11	21	23	2	25
5	45	18	63	0	0	0	45	18	63
6	48	30	78	19	50	69	29	-20	9
7	31	33	64	4	6	10	27	27	54
8	52	33	85	31	25	56	21	8	29
9	50	21	71	12	5	17	38	16	54
10	47	17	64	27	11	38	20	6	26
11	52	8	60	24	14	38	28	-6	22
12	36	22	58	21	21	42	15	1	16
13	41	31	72	15	36	51	26	-5	21
14	41	20	61	24	50	74	17	-30	-13
15	36	24	60	5	4	9	31	20	51
16	46	22	68	25	18	43	21	4	25
17	49	30	79	22	21	43	27	9	30
18	56	17	73	25	23	48	31	-6	25
19	56	28	84	31	22	53	25	6	31
20	47	21	68	2	7	9	45	14	59
SUM	868	457	1325	388	372	760	480	85	565
MEAN	43.40	22.85	66.25	19.40	18.60	38.00	24.00	4.25	28.25
STD	10.31	6.49	11.45	10.53	13.84	20.79	12.90	13.44	20.94
VAR	106.34	42.13	131.09	110.94	191.54	432.40	166.50	180.69	438.59

A: Pretest Outside World  
 B: Pretest Inner Self  
 C: Posttest Outside World  
 D: Posttest Inner Self

Table 1b

## VALUE VISION EXAMINATION SCORES - PRETEST &amp; POSTTEST [ ]

EXPERIMENTAL GROUP (OCTOBER 1988 - DECEMBER 1988)

n = 20

MEMBER	A	B	SUM1	C	D	SUM2	A-C	B-D	SUM1-SUM2
1	19	24	43	37	25	62	-18	-1	-19
2	58	20	78	40	25	65	18	-5	13
3	25	25	50	21	10	31	4	15	19
4	33	13	46	10	13	23	23	0	23
5	45	18	63	15	6	21	30	12	42
6	48	30	78	33	40	73	15	-10	5
7	31	33	64	15	6	21	16	27	43
8	52	33	85	37	25	62	15	8	23
9	50	21	71	14	3	17	36	18	54
10	47	17	64	36	14	50	11	3	14
11	52	8	60	20	11	31	32	-3	29
12	36	22	58	26	21	47	10	1	11
13	41	31	72	23	37	60	18	-6	12
14	41	20	61	30	46	76	11	-26	-15
15	36	24	60	6	5	11	30	19	49
16	46	22	68	27	19	46	19	3	22
17	49	30	79	22	21	43	27	9	36
18	56	17	73	18	25	43	38	-8	30
19	56	28	84	46	18	64	10	10	20
20	47	21	68	8	9	17	39	12	51
SUM	868	457	1325	484	379	863	384	78	462
MEAN	43.40	22.85	66.25	24.20	18.95	43.15	19.20	3.90	23.10
STD	10.31	6.49	11.45	11.08	11.71	20.04	13.17	11.83	19.29
VAR	106.34	42.13	131.09	122.76	137.15	401.53	173.36	139.89	371.99

A: Pretest Outside World  
 B: Pretest Inner Self  
 C: Posttest Outside World  
 D: Posttest Inner Self

Table 2

## VALUE VISION EXAMINATION SCORES -- PRETEST &amp; POSTTEST

CONTROL GROUP (FEBRUARY - MARCH 1989)

n = 24

MEMBER	A	B	SUM1	C	D	SUM2	A - C	B - D	SUM1 - SUM2
1	35	19	54	50	25	75	-15	-6	-21
2	41	29	70	32	41	73	9	-12	-3
3	39	12	51	47	18	65	-8	-6	-14
4	39	27	66	47	27	74	-8	0	-8
5	38	36	74	29	33	62	9	3	12
6	37	24	61	51	26	71	-14	-2	-16
7	50	34	84	52	30	82	-2	4	2
8	47	26	73	42	28	70	5	-2	3
9	36	21	57	53	18	71	-17	3	-14
10	45	23	68	50	22	72	-5	1	-4
11	37	13	50	51	16	67	-14	-3	-17
12	33	21	54	34	19	53	-1	2	1
13	39	34	73	42	25	67	-3	9	6
14	47	26	73	22	20	42	25	6	31
15	35	25	60	43	30	73	-8	-5	-13
16	48	35	83	41	95	136	7	-60	-53
17	69	13	82	64	19	83	5	-6	-1
18	54	21	75	48	19	67	6	2	8
19	41	16	57	49	18	67	-8	-2	-10
20	43	26	69	44	24	68	-1	2	1
21	60	55	115	45	59	104	15	-4	11
22	42	26	68	48	22	70	-6	4	-2
23	40	29	69	47	11	58	-7	18	11
24	37	26	63	36	31	67	1	-5	-4
SUM	1032	617	1649	1067	676	1743	-35	-59	-94
MEAN	43	25.71	68.71	44.46	28.17	72.63	-1.46	-2.46	-3.92
STD	8.35	8.99	13.58	8.73	16.58	17.23	9.97	13.38	15.36
VAR	69.67	80.79	184.54	76.25			99.33	179.08	235.83
				283.81	296.98				

A: Pretest Outside World

B: Pretest Inner Self

C: Posttest Outside World

D: Posttest Inner Self

VALUOMETRICS COURSE SUMMARY

1.0 PURPOSE OF THE COURSE

The purposes of the course in valuometrics were to: (1) strengthen the value vision and attendant moral sensitivity of the students, and (2) provide them with an objective method of making value judgements necessary in the ethical reasoning process.

2.0 MAJOR LEARNING OBJECTIVES

To obtain a knowledge of:

- a. The difference between philosophy and science as applied to ethics. Why ethics should become a science and how this transition was accomplished.
- b. The elements of set theory used in valuometrics.
- c. The nature and types of concepts.
- d. Hartman's theory of concept fulfillment, and the definition of the fundamental phenomenon of ethics.
- e. Difference between the concepts "goodness" and "value," and the implications of the objective definition of these two words.
- f. The nature of intrinsic value, extrinsic value, and systemic value.
- g. Hartmanian algebra and the value creation principle.
- h. How to see the outside world and the inner self through the valuometrics framework. (Learning objectives a - g are stepping stones to this objective.)
- i. How to apply the transposing transpositions process in order to redress injustices, wrongs, and badness.
- j. The use of valuometrics in ethics case studies.

3.0 IMPLEMENTATION OF THE COURSE

3.1 Text References

- a. Dept. of the Army FM 22 - 100, 1983.



b. Forrest, Frank G. Management Development Today, 1986.

c. \_\_\_\_\_, Valuometrics: the Science of Personal and Professional Ethics, 1988.

### 3.2 Schedule of Classes

The members of the experimental group were divided into two sections. Each section attended class twice a week for five and a fraction weeks, 31 Oct. - 7 Dec., 1988. During this period students attended eight class sessions of 80 minutes duration. The final two class sessions for each section were devoted to the value vision posttest and case study resolutions. Information relative to each class session is given in the following tabulation.

<u>Date of Class Session (1988)</u>	<u>Section Attended</u>	<u>Subject</u>
31 Oct.	1	Introduction
1 Nov.	2	Same
2 Nov.	1	Elements of Set Theory
3 Nov.	2	Same
7 Nov.	1	Concepts
8 Nov.	2	Same
9 Nov.	1	Hartman's Theory of Concept Fulfillment
10 Nov.	2	Same
14 Nov.	1	Hartmanean Algebra
15 Nov.	2	Same
16 Nov.	1	Same
17 Nov.	2	Same
21 Nov.		No class
22 Nov.	2	Value Vision Images, Transposing Transpositions

23-25 Nov.		Thanksgiving Day Holidays
28 Nov.	1	Value Vision Images, Transposing Transpositions
29 Nov.	2	Concept Combination Exercise; Case Study
30 Nov.	1	Same
1 Dec.	2	Value Vision Posttest - Part A and Case Study
5 Dec.	1	Same
6 Dec.	2	Value Vision Posttest - Part B and Case Study
7 Dec.	1	Same

### 3.3 Subject Content

INTRODUCTION: The importance of ethics in leadership; difference between philosophy and science as applied to ethics; contribution of Robert S. Hartmen to the development of scientific ethics; the fundamental phenomenon of ethics; value vision binoculars and their similarity to conventional binoculars; measuring value vision acuity; previous research in teaching ethics as a science; information on the current research project; the importance of official reports in the military services and the system of written reports that will be required by each student during the course.

ELEMENTS OF SET THEORY: Valuemetrics employs a mathematical system of general finite and transfinite numbers. These numbers, in a manner similar to conventional numbers, are derived from set theory. Elements of set theory which form the basis of various valuemetrics principles are: the definition of a set and set notation; equality and equivalence of sets; subsets; classification of sets; power set and empty set; set cardinality; infinite cardinalities and order of cardinal numbers.

CONCEPTS: The discipline concerned with the meaning of words is called semantics. Like set theory it is extensive and complex, but less structured. Elements of semantics used in valuemetrics are: the anatomy of concepts; types of definitions; types of concepts; perspective and context.

HARTMAN'S THEORY OF CONCEPT FULFILLMENT: Objective definition of goodness; clarification of the underlying logic of this definition using subsets; the difference between goodness and value; types of goodness associated with each type of concept; value dimensions (intrinsic, extrinsic, and systemic); value indexes -  $n$ ,  $k$ , and  $\aleph (A,)$ ; concept and value dimension hierarchy.

HEARTMANEAN ALGEBRA: This is a mathematical system originated by

Robert S. Hartman that accounts for the degrees of goodness resulting from the combination of concepts. The system involves operations with general finite and transfinite numbers. Components of the system are: the nature of a resultant concept; resultant concept compositions and transpositions; the arithmetic of the general finite and transfinite numbers; Hartmanean operations; the basic equation of Hartmanean algebra; the solution of concept combination problems using this equation; concept diagrams; value creation principle.

PRACTICAL APPLICATION OF VALUOMETRICS TO ETHICS: The nature of value vision and moral sensitivity; the value vision mathematical framework derived by Hartmanean algebra; how to apply this framework to images of the outside world and the inner self; the mathematics of creating value by redressing injustices, wrongs, and badness; case study.

#### 4.0 DISCUSSION

The purpose of the research project involving this course in valuometrics mandated that the instruction focus on the value vision test. The time available for the course also imposed this limitation. The value vision test is comparable to the physical training (PT) test. At the beginning of their ROTC training, cadets take a PT pretest. Thereafter and for the remainder of their cadetship they participate in training exercises to improve their physical ability. At the end of their military training they take a final PT test to determine if they meet certain physical ability standards. Under these conditions the PT posttest becomes an objective in and of itself. However, it is only an intermediate objective. The real objective of physical training is to build the strength and endurance of all cadets in order that they can meet the demands of their duties as Army officers. Similarly, the value vision posttest appeared to be the objective of the course in valuometrics when in fact the real objective was to improve the value sensitivity of the cadets in order to enhance their ability to meet the moral requirements of their positions as military leaders. The value vision test is a broad measure of this ability.

Value vision is only one of the facets of moral maturity development provided by studying valuometrics. Other aspects of this discipline which ought to

be included but were omitted because of time limitation are:

- a. Transposition topology and valuometrics syntax.
- b. The mathematics of fractional exponents and their use in determining when transpositions are justified.
- c. The technique of resolving ethics dilemmas.

## 5.0 SAMPLE VIEWGRAPHS

A sample of the viewgraphs and handouts used in the teaching of this course is attached. Information concerning each of the attached items is given in the following tabulation.

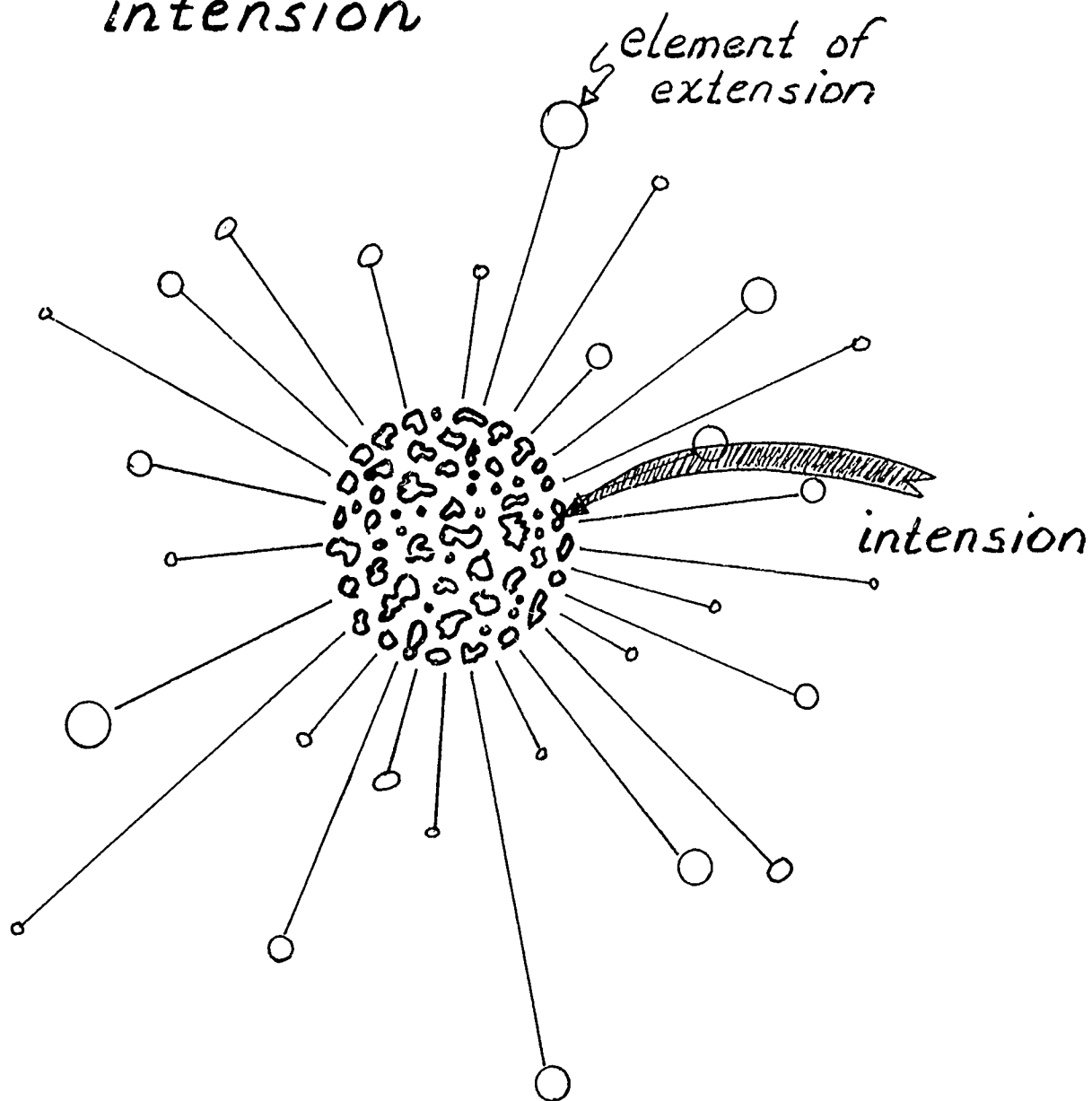
<u>No</u>	<u>Item</u>	<u>Description</u>
1	Structure of Concepts	A depiction of a concept. Used to illustrate the parts of a concept and their relationship.
2	Concepts	A chart pictorially and mathematically revealing the similarities and differences among the three types of concepts.
3	Table 2-1	A page from the manuscript -- <u>Valuometrics: the Science of Personal and Professional Ethics</u> . The symbols $k$ and $n$ , line 6, are the general finite numbers used in valuometrics, and the symbols $A_0$ and $A_1$ are transfinite numbers.
4	Concept Combination Process	This chart depicts the fundamental process in valuometrics. The notation "Vidx" means value index. A Vidx may be any one of the numbers $n$ , $k$ , $A_0$ , $A_1$ . . . .
5	Hartmanean Operations	An illustration of the mathematics of concept combinations.
6	Exponential Combinations of $n$ , $k$ , & $A_1$	This compilation of symbols and equations is the framework of the value vision chart. It may serve as a framework for a person's view of the outside world and inner self. In order to realize the power of the abstractions on this chart, a person must do more than learn the mathematics involved. He or she must know the real life meaning of these equations, and make a commitment to the vision gained by this understanding.

7 Case Study -- REPORT

An example of the use of valuemetrics in making value judgements.

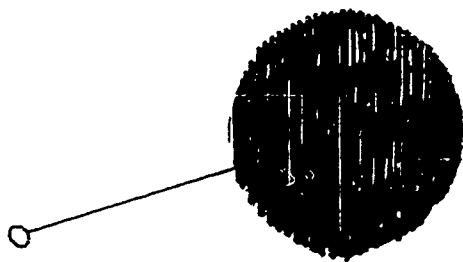
# Structure of Concepts

Components: extension &  
intension



# Concepts

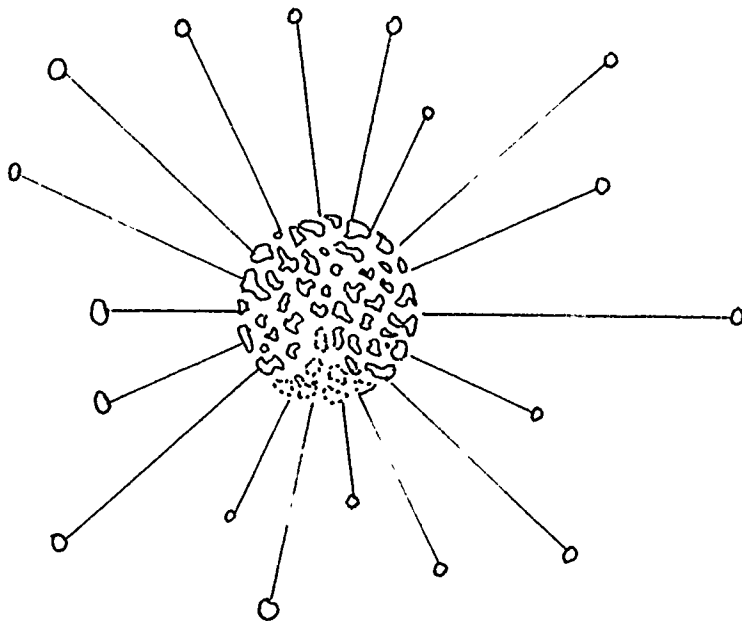
$C_1$



$$\mathcal{P} = IN$$

$$\text{Card } IN = A_1$$

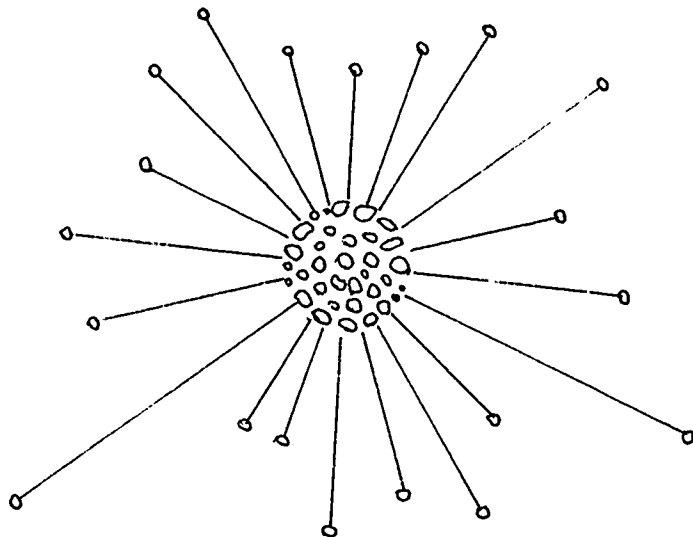
$C_2$



$$\mathcal{P} \subseteq IN$$

$$\text{Card } IN = k$$

$C_3$



$$\mathcal{P} = IN$$

$$\text{Card } IN = n$$

Table 2-1  
Concept Classification Summary

Classification criteria	Type Concept						
	Analytic				Construct		Singular
	Type I	Type II	Type III	Type IV	Social	Scientific	
1. Nature of referent	Tangible, natural objects	Tangible, man-made objects	Actions	Human roles	Human thoughts	Human thoughts, tangible objects	Tangible, spiritual
2. How referent is discerned	Perception	Perception	Perception	Perception	Conception	Perception and conception	Perception and conception
3. Type IN*	L-O-E	L-O-E	L-O-E	L-O-E	F-F	F-F	Nondenumerable infinite
4. P - IN relationship	$P \subseteq IN$	$P \subseteq IN$	$P \subseteq IN$	$P \subseteq IN$	$P = IN$	$P = IN$	$P = IN$
5. Comparison of ref's logical	Yes	Yes	Yes	Yes	No	No	** No
6. Card IN***	k	k	k	k	n	n	A, 1
7. Card EN	2 to A.	2 to A.	2 to A.	2 to A.	1 to A.	1 to A.	1

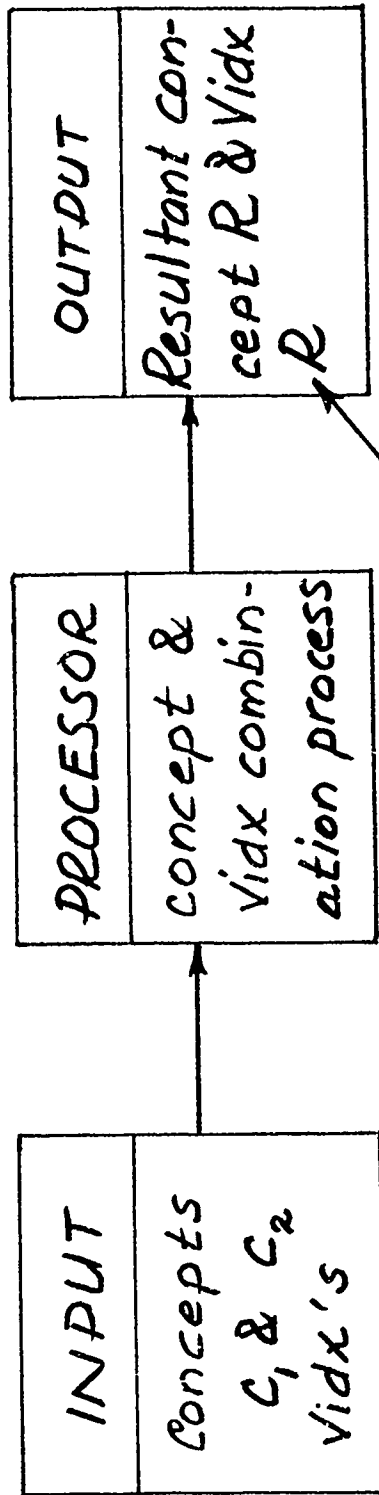
\* L-O-E: limited open-end F-F: fixed finite

\*\* Referents of a singular concept can be compared relative to their fulfillment of a role, but not relative to being a person. In the latter they are the same.

\*\*\* The hierarchy of these numbers provide a logical basis for the hierarchy of concepts.



# Concept combination process



is a composition  
or a transposition

## Hartmanean Operations

Concept combinations — exponentiation

Concept conjunctions — addition

Basic equation of Hartmanean algebra

$$R = C_x^{\pm C_y}$$

$$R = C_x^{C_y} \quad \text{if a composition, \&}$$

$$R = C_x^{-C_y} \quad \text{if a transposition.}$$

Basic Vidx equation is

$$\text{Vidx } R = \text{Vidx } C_x^{\pm \text{Vidx } C_y}$$

If  $\text{Vidx } C_x = k$  &  $\text{Vidx } C_y = \mathbb{A}$ ,

and if  $C_x$  &  $C_y$  combine as a composition, then

$$\text{Videx } R = k^{\mathbb{A}_1} = \mathbb{A}_2$$

and if  $C_x$  &  $C_y$  combine as a transposition then

$$\text{Videx } R = k^{-\mathbb{A}_1} = 1/\mathbb{A}_2$$

Interpretation

# Exponential Combinations of $n, k, A$ ,

	<u>Combination</u>	<u>Resultant</u>
1	$A_1^{A_1}, k^{A_1}, n^{A_1}$	$= A_2$
2	$A_1^k, A_1^n$	$= A_1$
3	$k^k, n^k, k^n$	$= k$
4	$n^n$	$= n$
5	$n^{-n}$	$= \frac{1}{n}$
6	$k^{-k}, n^{-k}, k^{-n}$	$= \frac{1}{k}$
7	$A_1^{-k}, A_1^{-n}$	$= \frac{1}{A_1}$
8	$A_1^{-A_1}, k^{-A_1}, n^{-A_1}$	$= \frac{1}{A_2}$

## Case Study    REPORT

### NARRATIVE

During the final days of the Kanchingunga offensive the company commander, Co. B, 17th Infantry, Captain Henry Rogers, received information from battalion one afternoon that they had unconfirmed information of enemy machine gun and mortar positions in the immediate vicinity of a terrain feature known as Point X. This area was directly astride B Co.'s axis of advance on the next day. Capt. Rogers decided to investigate the situation. He issued instructions to Lt. Tommy Smith to form a patrol of two squads from his platoon, and scout the area under the cover of darkness.

The terrain in B Co.'s sector consisted of numerous ridges and gullies characteristic of high elevation mountainous terrain.

The patrol departed the company area at 2000 hrs. The sky was clear, but the night was moonless. At the head of his patrol, Lt. Smith followed a dry creek bed which, according to a recent photo-map, would lead to a position from which they could employ their night vision equipment to make observations of the area around Point X. Around midnight while the patrol was still enroute, fog started to settle in gullies and ground depressions making it very difficult to distinguish terrain features. This caused Lt. Smith to veer off course and follow a branch of the creek bed which took him to a location similar to but different from the intended observation point. The patrol adequately reconnoitered the area assumed to be in the vicinity of Point X and found no positions occupied by the enemy, but it was the wrong area.

The patrol returned to B Co. in time for Lt. Smith to report to Capt. Rogers that no enemy positions were in the vicinity of Point X, and the company crossed the line of departure at the appointed hour two platoons abreast with Lt. Smith and his platoon in reserve. The company passed through the area of Point X without encountering enemy opposition. Upon reaching Point X, however, Lt. Smith

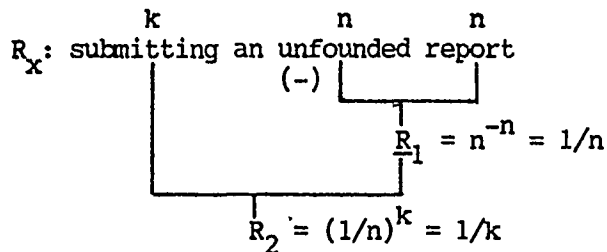
realized that he and his patrol had scouted the wrong area. At the same time he was much relieved because there was no enemy anywhere close-by. Late that afternoon, following a short but intensive skirmish, Co. B reached its objective and started digging-in. This was when Capt. Rogers approached Lt. Smith and complemented him on the fine job he and his patrol had accomplished prior to the attack. Capt. Rogers also mentioned that he was leaving Co. B to become the new Bn S-3, and that he had recommended to the battalion commander that Lt. Smith succeed him as C.O. Co. B.

#### PROBLEM

How should Lt. Smith respond? Why?

# SOLUTION

Statement of the situation in valuometrics syntax:

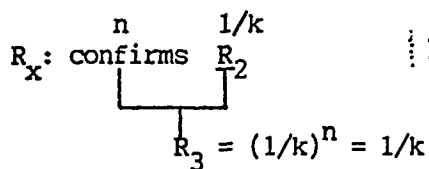


Courses of action available to Lt. Smith

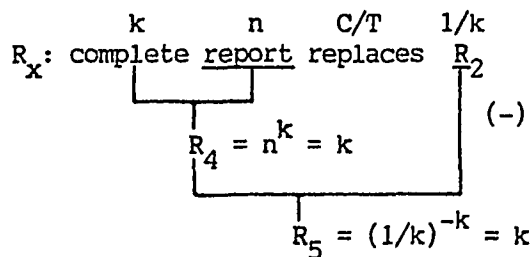
I. Thank Capt. Rogers for the complement.

II. Explain the mistake.

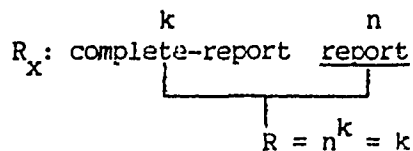
## Course of Action I



## Course of Action II



Transposition Correction Rule



INTERPRETATION Course of Action II is preferable to Course of Action I because  $k > 1/k$ .

SUMMARY OF  
INTERVIEWS WITH EXPERIMENTAL GROUP MEMBERS

During the period 15 January - 24 February 1989, Lt. Col. James H. McCord PMS, Army ROTC, Embry-Riddle Aeronautical University and Dr. Frank G. Forrest interviewed nineteen members of the experimental group. The purpose of this activity was to obtain from each member his feelings and opinions relative to valuemetrics as a tool for use in the ethical reasoning process, and his suggestions on how the course could be improved. Group members were interviewed individually. At the beginning of the interview each person was informed that his grade for the course had been determined and recorded, and that the persons conducting the interview were interested only in frank, critical comments. The interviewers found a high degree of consistency among members of the group concerning their views on the importance of ethics to leadership, what ethics was all about, what problems and confusions were encountered during the course, how valuemetrics enhanced their value judgment ability, and how the course could be improved. The gist of their comments is as follows.

There was unanimity in the experimental group concerning the great importance of ethics to leadership. Everyone agreed that how to determine and practice the highest moral good is what ethics was all about, and that the pretest and the posttest value vision examinations were related to ethics.

The majority of the persons interviewed claimed that the first part of the course was confusing and seemed to have no bearing on ethics. These remarks pertained to the instruction on set theory, concepts, and Hartman's theory given during the period 31 October -- 15 November 1988 (see Appendix , page 2).



However, approximately the middle of November things began to come together for most of the students. The majority were queried concerning whether or not they trusted the mathematics associated with valuometrics. All but one responded affirmatively. The student lacking this trust was the only one who failed the course final examination. . .

In order to improve the course there was general agreement: (1) that the pace of instruction should be slowed down, (2) that the length of the course should be extended, and (3) that more practical application exercises should be given.

The majority of the students in the experimental group, according to their comments as well as their performance on the posttest, exhibited a positive attitude toward the course, and they left no doubt in the minds of the interviewers that in most instances studying valuometrics had in varying degrees refined their moral beliefs.

FROM: W. E. Magill/EDS

10 Jan 1989

SUBJECT: Tentative Elective Schedule

TO: War and Morality Elective Attendees

1. Following is the tentative schedule for the War and Morality Elective:

<u>Session</u>	<u>Date</u>	<u>Time</u>	<u>Speaker/Activity</u>
1	11 Jan	1300	Dr Eve Gordon, "Morality"
2	17 Jan	1330	Lt Col William Stayton, "Ethics and the Military Profession"
3	25 Jan	1300	8 Feb - Judy & Jack Cumbee, "The Tenets of Pacifism"
4	31 Jan	1345	25 Feb - Maj Stan Newell, "Ethics of a POW"
5	8 Feb	1230	DISCUSSION - PAPER DUE (Para 2)
6	15 Feb	1245	11 Feb - "Ethics in a Nuclear World"
7	22 Feb	1400	"Ethics in a Nuclear World"
8	8 Mar	TBA	Wrap-Up Discussion (refer to schedule)

2. The paper referred to in session 5 is a no-threat exercise. All we ask you to do is jot down your beliefs regarding "ethics and the military" prior to the 8 Feb session. For example, one person last year indicated "Military ethics is winning on the battlefield (i.e., the ends justify the means).". Another person (a chaplain) was so concerned about ethical issues in the military that he is now on a leave of absence from the military to re-examine his beliefs on the ethics of nuclear war. Be prepared to openly and honestly discuss your beliefs.

3. If you have any questions, please see me in Room 231 or Major (Chaplain) Chuck Echols (ext 6679). I look forward to seeing you on Wednesday, 11 Jan 89.

WILLIAM E. MAGILL, Major, USAF  
Elective Chairman

## ACSC COMMAND ELECTIVE

### I. INTRODUCTION TO THE COMMANDER AND THE LAW -- 11 Jan 89 (1300) Lt Col Teschner, Maj Bowen, Maj Rosenow

- A. Course Overview (Maj Ivey)
  - 1. Introduction of Instructors
  - 2. Distribution of Course Outline and AU-2
  - 3. Overview of Course Objectives and Agenda
  - 4. Introduction of Guests
- B. Introduction to the Commander and the Law (Lt Col Teschner)
- C. Distribution of Materials
  - 1. The Military Commander and the Law
  - 2. Article on Fraternization
  - 3. Scenarios
- D. The Office of the Base Staff Judge Advocate
  - 1. Military Justice
    - a. Court-Martial Responsibilities
    - b. Article 15 Advice to Commanders
  - 2. Civil Law Division
  - 3. Claims Division

### II. OTHER KEY BASE AGENCIES -- 17 Jan 89 (1330)

- A. CBPO (Major Glisson)
  - 1. Action vs Reaction - Stay Ahead of the Game
  - 2. Who Does What - Know Your OPR
- B. Social Actions (Major Foessett)
- C. Family Support Center (Ms Simpkins)

### III. DEATH IN THE SQUADRON -- 25 Jan 89 (1300)

- A. Introduction (Maj Todd)
- B. Briefing on Chaplain Services
- C. Briefing on Mortuary Affairs Services
- D. Briefing on Personal Affairs Services (Mr Quenlin, 3800 ABW/DPAP)

### IV. SQUADRON COMMANDER SESSION I -- 31 Jan 89 (1345)

Former commanders share their command experiences and perspectives in an informal round-table discussion format. Students will have ample opportunity to ask questions; focus is on leadership and techniques for the effective running and interface of the squadron with other agencies (Chaplain, Coping with Death, Family Support Center, spouse groups, etc.)

V. NONJUDICIAL PUNISHMENT -- 8 Feb 89 (1230) Maj Bowen

- A. General Information
  - 1. Purpose
  - 2. Authority
  - 3. Persons Authorized to Impose Punishment
- B. Punishments
  - 1. Maximum Punishment Chart
  - 2. On Officers
  - 3. On Enlisted
  - 4. Punishment Alternatives
- C. Procedural Matters
- D. Appeals and Post Article 15 Relief
- E. Action on Records
- F. Case Study Discussion

VI. QUALITY FORCE MANAGEMENT -- 15 Feb 89 (1245) Maj Rosenow

- A. What is it?
  - 1. Discipline
  - 2. Education
  - 3. Removal of Substandard Personnel
- B. Tools
  - 1. Counseling
  - 2. Reprimand
  - 3. Personal Information Files (PIF)
  - 4. Unfavorable Information Files (UIF)
  - 5. Control Roster
  - 6. Demotion Actions
  - 7. Vacation of NCO Status
  - 8. Selective Reenlistments
  - 9. Airman Proficiency Ratings (APR)
  - 10. Weight Management Program
  - 11. Nonjudicial Punishment
- C. Administrative Discharges
  - 1. Types of Discharge
  - 2. Grounds for Discharge
  - 3. Processing Discharges

VII. SQUADRON COMMANDER SESSION II -- 22 Feb 89 (1400)

Former commanders share their command experiences and perspectives in an informal round-table discussion format. Students will have ample opportunity to ask questions. Focus this time is on quality of force issues and how these former commanders handled them; however, if you have questions on any commander related issues that we have not covered due to time constraints, this is the time to ask them.

VIII. RECAP AND WRAP-UP -- 8 Mar 89 (TBD)  
Lt Col Teschner, Maj Bowen, Maj Rosenow

- A. Comparison of Commander's Perspectives with Previous Seminars
- B. Recap Important Issues
- C. Answer Student Questions
- D. Complete Student Critiques of the Elective
- E. Closing Thoughts on Command

EXCERPTS FROM

VALUOMETRICS: The Science of Personal and Professional Ethics

Copyright by Frank G. Forrest  
2828 N. Atlantic Ave.  
Daytona Beach, FL 32018

Enclosure

## FOREWORD

Problems concerning value, good and bad, better and worse, are experienced by all of us in our daily affairs, but systematic inquiry concerning the nature of value has been a perennial task of the philosopher. Philosophers have defined value in all sorts of ways; it has been said to be pleasure, happiness, utility, the reasonable, mere emotion, whatever God says, and so on. Some have tried to develop sciences of value and morals; and some have said that such sciences are impossible, arguing that values are mere tastes, sentiments, or feelings, which by nature are subjective, and hence disorderly.

A scientist is one who brings order to disorder. Robert S. Hartman, the father of formal axiology, the logic of value, is the philosopher-scientist who has found the key to the order in our disorderly world of experienced values, our likes and dislikes, desires and aversions. One does not have to be sentimental in studying sentiment, Hartman explained, or emotional in studying emotion. The method of inquiry should not be confused with its subject matter. The value scientist, as a scientist, is not a valuer. Persons value, as persons, but not as scientists. As scientists, they seek to reveal the order or logic in the world of values.

Value science, as conceived by Hartman, is not an empirical or natural science like physics or chemistry, rather it is a formal science like mathematics or music theory. Hartman's formal axiology is a logic of value analogous to the logic of number, mathematics, and just as natural sciences like physics and chemistry are applications of mathematics in the realm of facts, so the social sciences, like psychology and sociology, can be applications of formal axiology in the realm of values.

As is mathematics, formal axiology is an axiomatic science. It rests on an axiom, a definition of value in general in terms of logic -- the logic of the intensions of concepts. Unlike traditional philosophical theories of value, which usually have their beginning in the attempt to define value in accord with specific types or species of value experiences -- whether moral, aesthetic, economic, religious, or something else -- formal axiology begins with a definition of the genus value, value in general, a statement of what all values, no matter what type, have in common. Obviously, such an axiomatic definition must be far removed from the rich diversity of our immediate experiences of values. If the definition is to cover all possible values, then only the logic, the "bare bones," of such experiences would be left. We are all acquainted with abstractions of this sort. Scientific formulas are no less removed from concrete experience. Thus  $C_{12}H_{22}O_{11}$  and  $V=S/t$  seem not to capture what we experience as sugar and as motion, but these formulas do provide us with very useful understandings of the forms of order or logic characteristic of our experiences of sugar and of motion. Such formulas become instruments of control enabling us to obtain, avoid, and modify types of experience. Accordingly, Hartman argued that all things to which value is attributed have something in common; namely, they all fulfill their concepts. Thus the axiom of formal axiology: a thing has value to the degree that it fulfills its concept. A horse, for example, is a good one if it has all the attributes of the concept "horse," and it is less than good to the degree that it lacks such attributes. Hence the standard, or measure, of value for anything is its concept or name. In short, its name is its norm.

As there are different types of names or concepts, so there are different types or categories of value as concept fulfillment. The logical elaboration of the various kinds of concepts and their fulfillment is the



logic of value, axiology, as a formal science, which Dr. Frank G. Forrest, the author of our text, terms "valuemetrics." The present work is a most welcome continuation of the development of the formal science of value begun by Robert S. Hartman, for Dr. Forrest's brilliant elaboration and application of valuemetrics reveal the power of this new and revolutionary science.

I had the privilege of working closely with Robert S. Hartman from 1950, when I became his graduate student at the Ohio State University, until his death in 1973 while a colleague at the University of Tennessee. I am sure that he would be delighted with the many remarkable contributions made in the present text to the development of formal axiology and to its application. I also have been privileged to work with Dr. Frank G. Forrest, the author of our text, during the past ten years in various activities associated with the Robert S. Hartman Institute for Formal and Applied Axiology. As a graduate of the United States Military Academy, a retired colonel, and an emeritus university vice president with an advanced degree in behavioral science, Dr. Forrest carries impressive credentials. That he is also a talented axiologist is extraordinary. The following text is a worthy product of this rare combination of such experience, knowledge and skill.

John W. Davis, Ph.D.  
Professor of Philosophy  
University of Tennessee  
Knoxville, Tennessee

## PREFACE

Valumetrics adds a new and powerful dimension to the reasoning process in ethics because it demonstrates that ethical decisions, traditionally based on valuational insights and subjective moralizing, can be made objectively through science. Hence, this book supplements and has the potential to replace present texts used in the teaching of ethics in colleges and universities as well as in the leadership development programs in industry, government, and the military services. The basis for this book is the postulate that ethics is a field of study that lends itself to scientific methodology and reasoning instead of a set of exhortations on how people should behave based on intuitions, sentiments, diverse philosophical principles, or tenets lodged in a realm beyond ordinary experience.

When applied to ethics the scientific method is a tool for sorting logically sound, emotion free value judgements from a confused and tangled web of complex variables. This method entails first, identifying the fundamental phenomenon of ethics and secondly, employing a system of logic -- a mathematics -- that models the behavior of the phenomenon. One of the outcomes of scientific ethics in the academic world is a logical sharing of the teaching of ethics between philosophy and the behavioral sciences. This subject also offers rich opportunities for research and development.

A substantial portion of the foundation of valumetrics consists of algebraic principles and processes. Therefore, successful completion of a course in high school algebra is a prerequisite.

An introduction and five chapters comprise the book. The introduction is a short discussion on the nature of valumetrics and its importance today. Chapter 1 covers certain fundamentals of set theory that also are part of the foundation of valumetrics. Concepts are another part of the foundation. They are the

subject of Chapter 2. Chapters 3 and 4 are devoted to the theory and the algebra of value. Chapter 5 contains explanations and illustrations of the application of valuemetrics to personal ethics and professionalism. This chapter also takes the reader beyond the basics of valuemetrics given in Chapter 4.

I am indebted to several persons for their assistance and encouragement in the writing of this book, especially John W. Davis, Ph D., University of Tennessee and Richard B. Morland, Ph D., Stetson University, Deland, Florida.

Frank G. Forrest

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## Introduction

### WHAT IS VALUOMETRICS AND WHY IS IT NEEDED?

Should business firms keep their share of the market by misrepresenting their products because others do it?

Is mercy killing right?

What is the difference between executing a spy and assassinating a terrorist faction leader?

What is the time from Paris to New York flying at 60,000 feet at mach 3?

These question and many others like them are about things that concern us today, but one of them seems out of place. All four questions are legitimate, and convincing answers to the first three can be given on the basis of opinion. When this method is used, the answers will vary among a sample of responses. The answer to the last question, however, is different from the others because it can be determined by the method of science. Given certain information such as weather conditions, all persons who know the method will derive the same answer. This raises the question of whether there is a scientific method for determining the answers to the first three questions. The reply to this question is "yes." It is known as valuometrics.

Valuometrics is a system of logic that accounts for quality similar to the way conventional mathematics -- also a system of logic -- accounts for quantity. The unit of mathematics is number and calculations are performed with numbers. The unit of valuometrics is value index and operations are performed with value indexes. A value index is an abstract symbol in a system, not a human intuitive judgment of the worth of something or a standard known as a "human value." However, valuometrics is related to both worth and standards in that it enables us

to determine standards and gradations of worth objectively.

The great disparity today between our knowledge of facts, on the one hand, and our knowledge of value on the other has produced a serious problem for people worldwide. "In the form of natural science," says Henry N. Wieman a University of Chicago professor of theology, "we have an ever increasing power to transform the physical world in any way desired. But we have no proportionate and parallel system of values to direct the use of this power." A famous World War II American general, Omar Bradley said, "Our knowledge of science has clearly outstripped our capacity to control it . . . Ours is a world of nuclear giants and ethical infants." Elton Mayo, a respected behavioral science researcher, says that: "the consequences for society of the unbalance between the development of technical and social skill has been disastrous." Abraham Maslow, a well known humanistic psychologist, made this observation: "The ultimate disease of our time is valuelessness; . . . this state is more crucially dangerous than ever before in history; . . . something can be done about it by man's own rational efforts."

It was mankind's rational efforts that advanced civilization out of the darkness of the medieval world to the high technology of today's world. This occurred initially when the explanation of natural phenomena evolved from various speculations to analysis and synthesis which characterize such sciences as physics, chemistry, and biology. A corresponding transition of moral philosophy to moral science, however, has not occurred. This situation exists neither because philosophers and mathematicians have not attempted to produce a science of ethics nor because the method of science is incompatible with ethics. Both Rene Descartes (1596-1650) and Gottfried<sup>c</sup> Leibniz (1646-1716), the person who developed differential calculus, attempted to found a science of ethics on the method of natural science, but failed. They and others were unsuccessful because they lacked the necessary axioms from which thought and reasoning could proceed,

and which would give rise to a system of logic that would model the fundamental phenomenon of ethics. Fortunately, both of these deficiencies have been overcome recently by a research professor at the National University of Mexico and the University of Tennessee, Robert S. Hartman (1910-1973). The results of his research and development are contained in a text on scientific axiology, Hartman (1967). Axiology is defined as: "the study of the nature, types, and criteria of values and value judgements."

In this work Hartman distinguishes between two methods of developing knowledge -- philosophic and scientific, and he explains how the method of science is applicable to the study of such phenomena as goodness and value which previously were in the exclusive domain of philosophy. Using the insights of a Cambridge University professor, George E. Moore (1873-1958), to guide his inquiry, Hartman proceeds to define goodness objectively. This definition serves as a basis for the elaboration of a system of logic utilizing Cantorean set theory that orders and accounts for instances of goodness. Whereas the works of Moore and Georg Cantor (1848-1918) contributed to the foundation of Hartman's thinking, they are only two of the many scholars who were influential in the development of his theories.

Anyone who studies Hartman looking for a finished model of scientific ethics unfortunately will be disappointed. He compiled the theory and mathematics for such a model, but his untimely death in 1973 prevented him from completing it. In order to fulfill this need, segments of Hartman's writings have been extracted and a working model of scientific ethics called "valuemetrics" has been assembled in this book. This discipline consists of the application of set theory and Hartmanian algebra to the study of goodness and its various gradations. The ability to discern these gradations by intuition, logic, or by both is known as one's value vision.



Although valuometrics is comparatively new, sufficient development has been achieved for utilization by anyone in his or her personal life, as well as by leaders and managers of organizations including those in business, education, government, the armed forces, and public service.

One of the outcomes that will result from a study of valuometrics is an enhancement of an individual's capacity for making value judgments. This outcome is based on: (1) the premise that a value judgment is an assessment of the goodness of something, and (2) the determination of goodness and ordering it with precision is the sum and substance of valuometrics. Learning the principles of valuometrics and applying them correctly will provide one with possible segments of new meaning in life. The manner of thinking and the viewpoints acquired, at first, may feel strange. The reason for this unfamiliar feeling is that value and goodness will have advanced from arbitrary notions to precisely defined concepts. Accordingly, one should expect some new solutions to problems in ethics previously solved by unaided intuition, common sense, instinct, or conscience. If persons permit the strangeness of these solutions to deter them from the action indicated, then the relation of our technological ability and our axiological ability will remain perilously disproportionate, possibly to the detriment of ourselves and future generations.

## Chapter 4

### HARTMANEAN ALGEBRA

Hartmanean algebra, originally developed by Robert S. Hartman, is a mathematical system that accounts for the outcome of linking and merging concept intensional sets. In set theory there are operations with sets per se, and there are operations with their cardinal numbers. Hartmanean algebra uses the latter. Persons using this mathematics must keep in mind the difference between a concept and its referent, and they must think both intensionally and extensionally.

The symbols " $C_x$ ," " $C_y$ ," and " $R_x$ " are added to our list of notations. The capital letter "C" denotes the name of an intensional set. This is the same word that names the thing defined by the intension. The lower case letters "x" and "y" represent any natural number starting with 1. The symbol " $C_1$ " means concept number 1, and " $C_2$ " means concept number 2. When two concepts are combined they produce a resultant concept designated by the letter "R".

#### 1.0 CONCEPT CONJUNCTIONS AND COMBINATIONS

The difference between concept conjunction and concept combination can be illustrated using chemical processes as an analogy. Chemical mixtures, salt and pepper, for example, retain their properties when intermingled and are analogous to concept conjunctions. Chemical compounds such as two parts of hydrogen and one part of oxygen, on the other hand, are a new substance (water) and are analogous to concept combinations. This method of associating concepts is the more important and, hence, is of primary concern to Hartmanean algebra. Concept combinations are people's thought creations which find their expression in language. In certain respects, concepts are like geometric figures. As rectangles, triangles, and circles have different structures; construct, analytic, and

singular concepts have different intensional structures. Geometric figures may be combined in any number of arrangements and patterns. So may concepts. Geometric figure combinations offer a method of visualizing concept intension combinations. The combination of a right triangle and a rectangle in a certain manner produces a trapezoid as shown in Figure 4-1.



Figure 4-1. Formation of a Trapezoid

The combination of the concept "person" ( $C_1$ ) and the concept "marriage" ( $C_2$ ) in a similar manner produces the concept "spouse" ( $R$ ).

$$\text{person } (C_1) \text{ and marriage } (C_2) = \text{spouse } (R)$$

The resultant  $R$  in this example is a combination because it is a modification of the underlying concepts  $C_1$  and  $C_2$ . Many single words like "spouse" are a combination of two or more underlying concepts. The intensions of the underlying concepts become subsets of the resultant intension. This relationship also exists between a concept intensional set of a concept defined propositionally and the intensional sets of its elements. However, concepts which are elements of an intensional set do not modify each other. Underlying concepts do. Those concepts which have no underlying concepts are prime concepts. The names of all chemical elements and objects in nature, such as mountain, tree, and cloud are examples of prime concepts.

Geometric figures have areas. The corresponding feature of concepts are their value indexes. When two geometric figures are combined, so are their areas. Computation of the new area is possible using certain procedures and conven-

tional arithmetic. When two concepts are combined so are their value indexes. Computation of the resultant concept value index is possible using the arithmetic of general finite and transfinite numbers and other procedures. Various operations with the numbers  $n$ ,  $k$ , and  $\aleph$ , in accordance with this arithmetic are the essence of Hartmanean algebra.

The most basis combination consists of two prime concepts and attendant value indexes which combine as a composition or a transposition. The diagram of an open system, Figure 4-2, depicts this process.

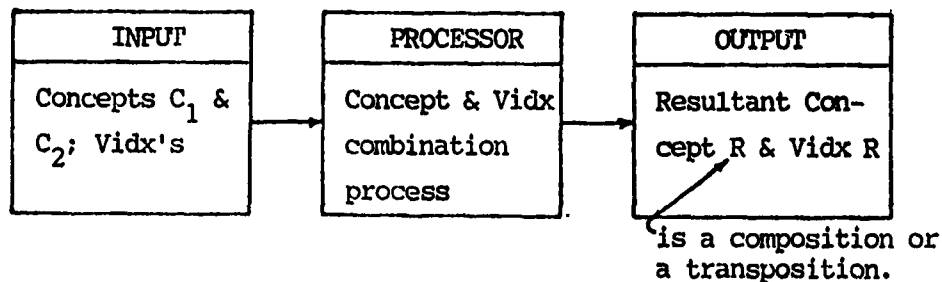


Figure 4-2. Concept Combination Process

### 1.1 Concept Combination Composition and Transposition

Concept combinations are compositional or transpositional depending on:

- (1) how the combination affects the intensions of the input concepts directly or indirectly, immediately or long term, and (2) whether or not the extensional set (EN) of the resultant concept (R) is an empty set ( $\emptyset$ ).

Input Concept IN Fulfillment If the input intensions are complementary and promote fulfillment of one or the other, a value enhancement has occurred. Value enhancement is compositional. If the input intensions are incompatible and inhibit fulfillment of one or the other, a disvalue has occurred. Disvalue is transpositional. Concept intensions essentially are meanings. When the meaning of at least one input concept is broadened or deepened, the combination is

Chapter 4  
Sections 8.0 - 11.0

$$\text{Vidx } R_{2a} = (n^n)(k + A_1) = n^{A_1} = A_2.$$

## 8.0 CONCEPT DIAGRAM

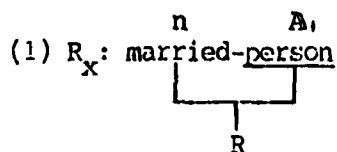
Finding the final value index of a complex idea given in a sentence requires translating the sentence from a string of words to a network of concept combinations. The structure of this network reflects the manner the various prime concepts and resultant concepts are related. Concept diagrams as shown below are useful in developing and displaying this network.

Equation	Concept Diagram
$R = C_1^{C_2}$ $*R = k^k = k$	
$C_1 + C_2$	$[C_1 C_2]$
$R_{2a} = R_1^{C_3}$ $R_1 = A_1^k = A_1$ $R_2 = A_1^{-k} = 1/A_1$	
$R_{2b} = C_3^{R_1}$ $R_1 = A_1^k = A_1$ $R_2 = k^{A_1} = A_2$	

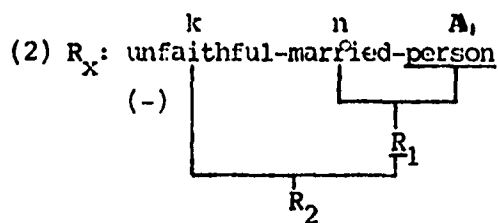
\* Henceforth, the symbol R will be used to denote both a concept combination resultant and its Vidx.

Equation	Concept Diagram
$R_{2b} = (C_3 + C_4)^{R_1}$ $R_1 = k^n$ $R_2 = (A_1 + A_1)^k = A_1$	

### EXAMPLES

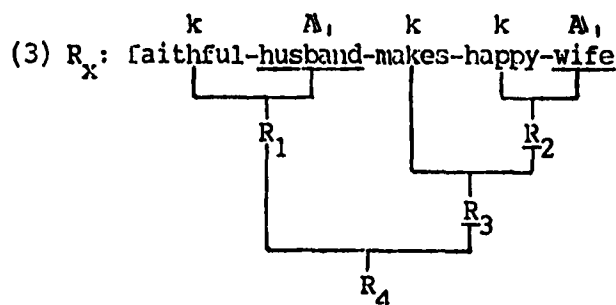


$$R = A_1^n = A_1$$



$$R_1 = A_1 \text{ Example (1)}$$

$$R_2 = A_1^{-k} = 1/A_1$$



$$R_1 = R_2 = A_1 \text{ Example 4-3}$$

$$R_3 = A_1^k = A_1$$

$$R_4 = A_1^{A_1} = A_1$$

### 9.0 INTERPRETATION

In order to interpret the solutions to problems using Hartmanean algebra ask "how does the combination of concepts in the situation under consideration affect the generation of value?" There are three possible modes: (1) value creation, (2) value neutral, and (3) value depreciation. When the value index of the combination or combination network exceeds the largest input concept

value index, value has been created. When the final resultant value index is less than the smallest input concept value index, value has been depreciated. All other relationships between the final value index and the input value indexes are value neutral. Example (2) in the previous section is an instance of value depreciation and Example (3) is value creation. These two situations are easy to evaluate and a mathematical system is not required to show that faithfulness and happiness is better than unfaithfulness. Neither are a principle in physics and the arithmetic of finite numbers required to indicate that running 100 yards at eight miles per hour will take less time than walking it at five miles per hour. However, the same scientific principle and mathematics that will solve this simple time-rate-distance problem also solves complex problems such as those encountered in supersonic intercontinental navigation. Similarly, the same mathematical system which shows us that Example (3) is better than Example (2) will provide insight for the resolution of more complex problems. The purpose of these examples at this point is to illustrate a process and validate the results, not resolve a complicated issue. The application of Hartmanean algebra to controversial situations will be seen in the next chapter.

#### 10.0 VALUE CREATION PRINCIPLE

The relation between the final value index and the input value indexes of a concept combination network is the basis for a principle usable as a guide in making value judgments and decisions. This principle, the Value Creation Principle, reads as follows.

Select courses of action, ideas, or forms of behavior that result in value creation or that, secondarily, are value neutral. Avoid those that depreciate it.

The following statement is a corollary of this principle.

When two or more courses of action, ideas, or forms of behavior having different value indexes are being considered, choose the one having the highest value index.



## 11.0 TRUTH AND UNIVERSALITY

The truth of the outcome of a properly completed Hartmanian algebra problem depends on the correctness of the concepts used and the truth of the relationships that are given. This system, like all mathematical processes, exists independent of any other phenomenon and, hence, has no way of discriminating incorrect inputs relative to a given situation. When valuometrics is used as a basis for value judgments, it is essential that the input concepts and their relationships reflect truth and reality; otherwise the results will be valueless. If one is ignorant or unsure of the facts in a situation, consulting authentic reference material or an expert on the matter is advisable prior to applying valuometrics.

Whereas the mathematical system of valuometrics is universal, the meanings of all concepts are not. Construct concepts are subject to this condition. The concept "marriage," for example, in the Judeo-Christian culture might have a different meaning from the word used to denote entering into the husband and wife relationship in another culture. This does not invalidate valuometrics because intensional sets in the final analysis are the items of interest to us, not the concept. We use concepts in valuometrics in the interest of expediency. A concept is a single word which symbolizes a particular intensional set. In the valuometrics context, a given concept can have no more than one intension. However, a particular intension can have more than one concept. When this occurs, the concepts concerned are synonyms. When we find dual or multiple intensional sets connected with a concept, as occurs among different cultures and sometimes between different social classes within a culture, then a concept must be found or coined for each of the different intensions.

Chapter 5  
Sections 3.0 & 5.1

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action to redress injustice, wrongs, and badness.

#### The Transposition Correction Rule

When transposing a transposition for the purpose of redressing injustice, wrongs, and badness select a course of action concept which if combined directly with the base concept of the transposition is not also a transposition.

A definition of injustice, wrong, and bad in valuemetrics terms is:

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DEFINITION 5-1. Injustice, wrong, and bad are any first instance transpositional concept combination or any second instance transpositional concept combination which violates the transposition correction rule.

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In Example 5-1,  $R_2$  is a first instance transposition and  $R_3$  is a second instance transposition.

### 3.0 JUSTIFYING TRANSPOSITIONS

Transpositions abound in nature and in human affairs. Animals kill each other. Lightening causes forest fires and destruction. People go to war. Are transpositions ever justified? In valuemetrics anything is justified to the degree value is created or held neutral. Can a transposition be used to create value? In the previous section we saw how transposing transpositions created value, but this is not an instance of using a transposition to create value. When we transpose a transposition, the transposition is the base in the exponential expression. When we use a transposition, it is the exponent. Our examination of the question, "Are transpositions ever justified?" will begin with a review of the arithmetic involved. Then we will look at real world examples which the mathematics models.

When a transposition is the exponent in the basic equation of Hartmanian algebra, the exponent is a fraction. Fractional exponents are roots. The arithmetic of general finite and transfinite roots is given in Appendix A. The

relationship between whole number exponents and fractional exponents - roots - is similar to the relationship between addition and subtraction, One is the inverse of the other; for example,  $5^2 = 25$  and  $25^{\frac{1}{2}} = 5$ . Table 5-5 shows the results of this process with the numbers  $n$ ,  $k$ ,  $A_0$ ,  $A_1$ ,  $A_2$ ,  $A_3$ , and  $A_4$ .

Table 5-5

Exponents and Roots Relationship

Exponent	Root	Exponent	Root
$n^n = n$	$n^{1/n} = n$	$A_2^{A_0} = A_1$	$A_2^{1/A_0} = A_1$
$k^n = k$	$k^{1/n} = k$	$A_3^{A_0} = A_1$	$A_3^{1/A_0} = A_1$
$A_0^n = A_0$	$A_0^{1/n} = A_0$	$n^{A_1} = A_2$	$A_2^{1/A_1} = n$
$A_1^n = A_1$	$A_1^{1/n} = A_1$	$k^{A_1} = A_2$	$A_2^{1/A_1} = k$
$A_2^n = A_2$	$A_2^{1/n} = A_2$	$A_0^{A_1} = A_2$	$A_2^{1/A_1} = A_0$
$A_3^n = A_3$	$A_3^{1/n} = A_3$	$A_1^{A_1} = A_2$	$A_2^{1/A_1} = A_1$
$n^k = k$	$k^{1/k} = n$	$A_2^{A_1} = A_2$	$A_2^{1/A_1} = A_2$
$k^k = k$	$k^{1/k} = k$	$A_3^{A_1} = A_3$	$A_3^{1/A_1} = A_3$
$A_0^k = A_0$	$A_0^{1/k} = A_0$	$n^{A_2} = A_3$	$A_3^{1/A_2} = n$
$A_1^k = A_1$	$A_1^{1/k} = A_1$	$k^{A_2} = A_3$	$A_3^{1/A_2} = k$
$A_2^k = A_2$	$A_2^{1/k} = A_2$	$A_0^{A_2} = A_3$	$A_3^{1/A_2} = A_0$
$A_3^k = A_3$	$A_3^{1/k} = A_3$	$A_1^{A_2} = A_3$	$A_3^{1/A_2} = A_1$
$n^{A_0} = A_1$	$A_1^{1/A_0} = n$	$A_2^{A_2} = A_3$	$A_3^{1/A_2} = A_2$
$k^{A_0} = A_1$	$A_1^{1/A_0} = k$	$A_3^{A_2} = A_3$	$A_3^{1/A_2} = A_3$
$A_0^{A_0} = A_1$	$A_1^{1/A_0} = A_0$	$A_4^{A_2} = A_4$	$A_4^{1/A_2} = A_4$
$A_1^{A_0} = A_1$	$A_1^{1/A_0} = A_1$		

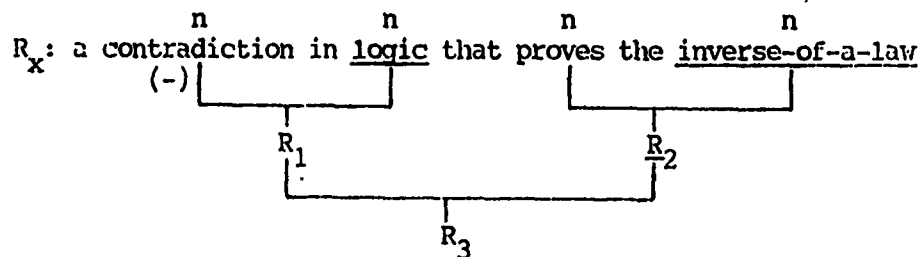
The relationships in Table 5-5 are the basis for the following rules concerning fractional exponents.

- (1)  $n, k, A_0, A_1, \dots$  raised to the  $1/n$ th power equals  $n, k, A_0, A_1, \dots$
- (2)  $k, A_0, A_1, \dots$  raised to the  $1/k$ th power equals  $n$  or  $k, A_0, A_1, \dots$
- (3)  $(A_{x+1})^{1/A_x} \leq A_{x+1}$
- (4)  $n^{1/k}, n^{1/A_x}, k^{1/A_x}, A_x^{1/A_x}$ , and  $A_x^{1/A_{x+1}}$  are indeterminates, symbolized as "d." This symbol is similar in nature to the mathematical factor "i," the symbol for  $-1^{1/2}$  ( $\sqrt{-1}$ ). Both i and d are different from any other number.

According to the value creation principle, all the cases that come under rules (1) - (3) are justifiable transpositions, and those cases to which rule (4) applies are not.

Rule (1) means that the systemic disvalue of a human construct by another is justified if it promotes the fulfillment of anything else.

#### EXAMPLE 5-2



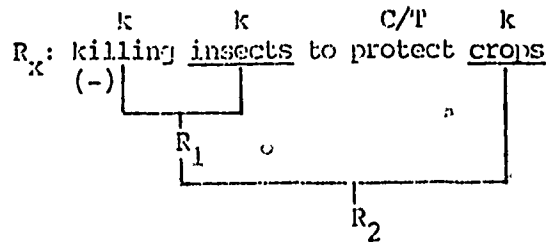
$$R_1 = n^{-n} = 1/n$$

$$R_2 = n^n = n$$

$$R_3 = n^{1/n} = n$$

Rule (2) means that the extrinsic disvalue of something tangible that is not the referent of a construct concept is justified if it promotes, serves, protects, or enhances anything else.

EXAMPLE 5-3

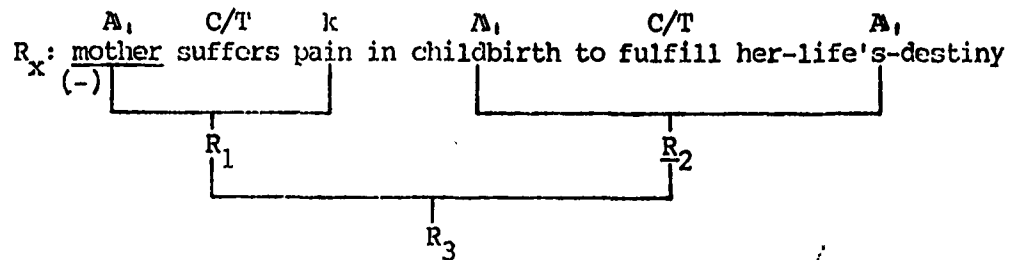


$$R_1 = k^{-k} = 1/k$$

$$R_2 = k^{1/k} = k$$

Rule (3) means that the systemic or extrinsic disvalue of a person is justified provided the disvalue leads to the fulfillment of a higher intrinsic value.

EXAMPLE 5-4



$$R_1 = A_1^{-k} = 1/A_1$$

$$R_2 = A_1^{A_1} = A_2$$

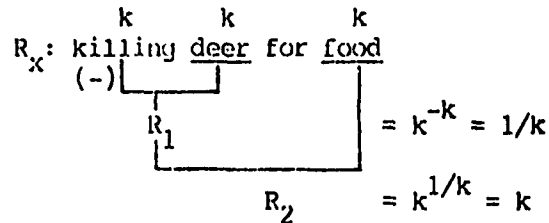
$$R_3 = A_2^{1/A_1} < A_2$$

Rule (4) means that the extrinsic disvalue of a construct, or the intrinsic disvalue of a construct or something tangible, or the intrinsic disvalue of a person, or the disvalue of a person by a higher order intrinsic value are not justified. Examples of referents of the concept combinations under rule (4) are:

- (1)  $n^{1/k}$ : sacrifice of an animal to fulfill a religious ideal.
- (2)  $n^{1/A_1}$ : sacrifice of a person for the same purpose.
- (3)  $k^{1/A_1}$ : killing a person for revenge.
- (4)  $A_1^{1/A_1}$ : scapegoat (a person suffering incarceration, pain, or death for the benefit of other).
- (5)  $A_1^{1/A_2}$ : father sells daughter to buy jewelry for himself.

The resolution of transposition justification problems ought always be examined in light of the long range consequences of the justification.

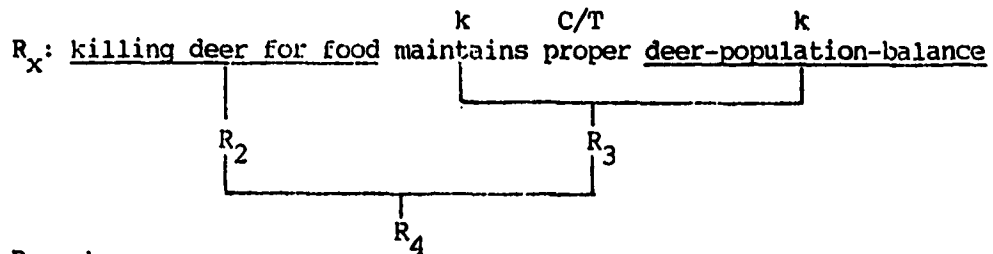
EXAMPLE 5-5



$R_X$  is justified by rule (2).

Examination of this justification with respect to its effect on the deer population involves two possible cases.

Case 1

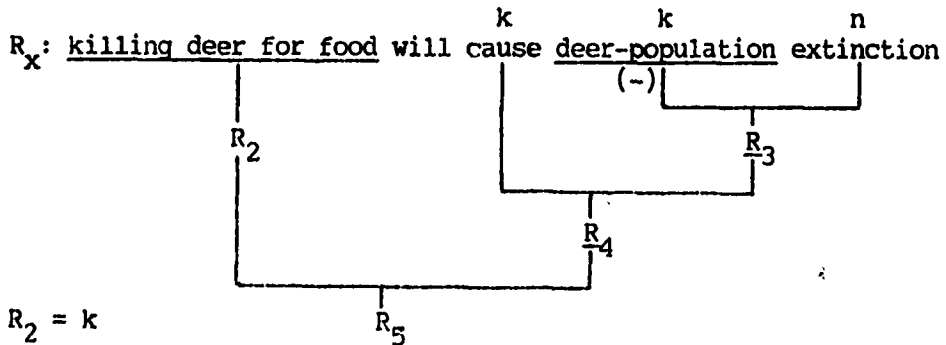


$$R_2 = k$$

$$R_3 = k^k = k$$

$$R_4 = k^k = k$$

Case 2



$$R_2 = k$$

$$R_3 = k^{-n} = 1/k$$

$$R_4 = (1/k)^k = 1/k$$

$$R_5 = (1/k)^k = 1/k$$

INTERPRETATION

Under the conditions of Case 2, killing deer for food is not justified.